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Indicating Pyrometers are Profitable in The Metal Industry

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The Use for Pyrometers in All the Various Kinds of Non-Ferrous Metal Melting Plants

THERE are many applications in the metal industry where the use of an indicating pyrometer will not only be found most profitable, but in many cases the indicating pyrometer is the only type that can be conveniently and economically used.

For some applications, however, a pyrometer that automatically controls as well as indicates the temperature may be more desirable and offer an advantage over the pyrometer that only indicates the temperature.

In choosing an installation, a comparison of initial cost and upkeep must be given careful consideration.

In shops where only small amounts of metal are handled or where the need for a pyrometer is not continuous, the indicating pyrometer may prove to be considerably more profitable.

For service where the conditions are severe, such as in the non-ferrous foundry, the portable indicating pyrometer offers the most practical and economical means of obtaining accurate temperature information.

This article summarizes the importance of temperature and outlines in general the type of pyrometer that best serves the requirement in the average shop.

Hot Dip Galvanizing

The hot dipping process of galvanizing, as its name implies, is the application of coating by dipping the material into a molten bath of zinc. The temperature of the bath has a decided influence on the re-

sults obtained as well as on the dross formation.

The weight or thickness of the zinc deposit is influenced decidedly by the temperature of the bath and the length of time the part being galvanized is allowed to remain in the bath.

More zinc is consumed at the higher temperatures and, therefore, the bath temperature should be kept as low as possible—never exceed 870° F. unless the work to be galvanized is of such a nature that higher temperatures are absolutely necessary, and this is rare. Zinc dross forms with great rapidity after passing 870° F. At a kettle heat of 900° F. the formation is so marked that quantities of dross remain in suspension within the zinc bath. When this happens every effort to get a good finish will be defeated. Generally speaking, therefore, the best results and the most economical consumption of both metal and fuel is obtained at temperatures of 820° F. to 850° F.

Pyrometer Recommended

If the galvanizing kettles are heated by solid fuel, automatic control type pyrometers would be of little or no value. The temperature would be largely regulated by the attendant, and the use of an indicating pyrometer, either portable or permanently mounted stationary type, would be best.

As to whether a portable or a permanently installed unit should be used is a question that the individual plant must decide depending on their requirement.

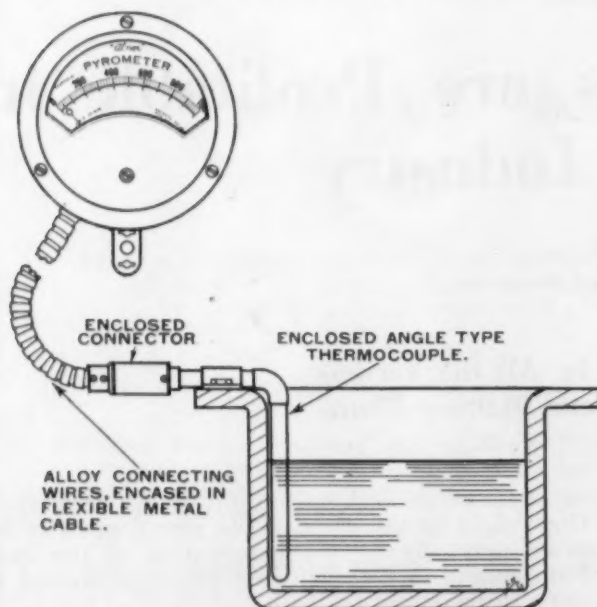
Wall Type Pyrometer Stationary Thermo-Couple Installations

Where it is desired to have the thermo-couple remain in the metal bath continuously so that the temperature of the bath is indicated on the pyrometer at all times, the thermo-couple must be enclosed in a suitable protection tube to protect it against the corrosive and contaminating action of the bath.

For the most satisfactory results with the permanently installed thermo-couple units, it is recommended that the connecting wires be lead covered or enclosed in conduit; otherwise the acid and acid fumes will quickly eat the wire insulation and cause trouble from short circuits and erratic readings.

Tinning

Tinning, which is also a form of rust-proofing, is similar to galvanizing but the contaminating action of the bath on thermo-couples is not quite so severe



Typical Installation of a Pyrometer with Soft Metal Pot

although the corrosive action of the acid and acid fumes is probably greater.

The temperature of the tin bath should be 650° F. to 700° F. depending upon the speed with which the work is handled and the size of the pieces being tinned.

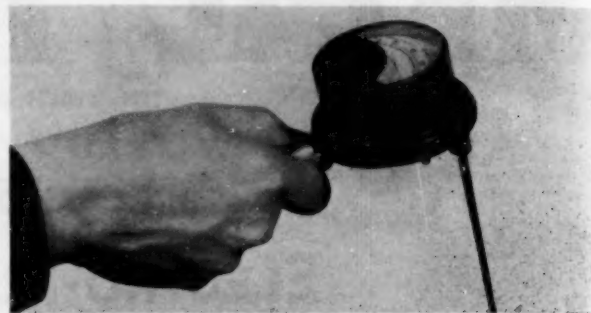
To run too cold will not produce results, while if the bath is too hot excessive oxidation of the metal takes place, fuel is wasted, and the quality of the work may suffer. Uniform temperature will produce uniform results for a given class of work, and the costs will be kept as low as possible.

Pyrometer Recommended for Tinning Baths

Whether to use a portable or a stationary pyrometer will depend largely on the individual requirement in the plant.

Where a number of small tin pots are used and the user does not want to make an outlay of money to equip each pot with a stationary unit, the portable pyrometer makes an ideal unit. However, in the long run to have a pyrometer installed permanently with each pot will be more satisfactory.

On account of acid fumes, it is recommended that the connecting wire be lead covered or run in conduit, that the connector block or terminal head be



Portable Pyrometer for Quick Temperature
Readings of Molten Soft Metal

enclosed type, and that the thermo-couple be encased in a suitable protection tube.

Babbling

Heavy machinery manufacturers, such as conveying and handling equipment and engine builders, use quite large quantities of babbitt for bearings. Babbitt metal differs considerably as to composition depending on requirement. Likewise the melting and proper pouring temperature varies with the composition of the alloy and the size of the bearing to be cast. The metal must be hot enough to fill out the bearing but not so hot that the metal will oxidize excessively or the alloys separate.

Pyrometers for Babbitt Metal

The same recommendations for tinning baths applies to babbitt pots, except that the extra outer tube need not be used. Also in some cases a straight thermo-couple can be used with regular connector which will reduce the cost of the installation somewhat.

Machine Soldering

Soldering is commonly thought of as being done with a soldering iron. However, there are certain industries, such as tin can making, where soldering is done by machine.

In this process the cans or parts to be soldered are conveyed through a molten bath of solder, the work being so held that the metal touches only the part that is to be soldered.

In other industries, such as automobile radiator manufacture, the work is dipped by hand or machine in the solder bath to the required depth.

The temperature of the solder bath is highly important to good results as well as fuel consumption and likewise costs.

The proper temperature will depend upon the speed of soldering the size of the articles. This temperature will run between 500° F. and 600° F.

In most cases it will be more desirable to install a stationary wall type pyrometer so that the temperature of the metal is always shown whenever it is hot.

White Metal Casting

White metal castings are generally made in permanent molds, by hand pouring or by die casting machines. Among the hand poured white metal cast-

ings are casket hardware, statuary castings, book ends, etc.

There are four alloys in common use for die castings and other white metal castings:

- 1—Lead base alloy castings.
- 2—Tin base alloy castings.
- 3—Zinc base alloy castings.
- 4—Aluminum base alloy castings.

Each has its special use, and due to the composition each alloy has its own proper pouring temperature for the size of casting being made.

In general casting temperatures are as follows:

Tin and lead base alloys 500° to 700° F.

Zinc base alloys 850° to 950° F.

Aluminum alloys 1200° to 1400° F.

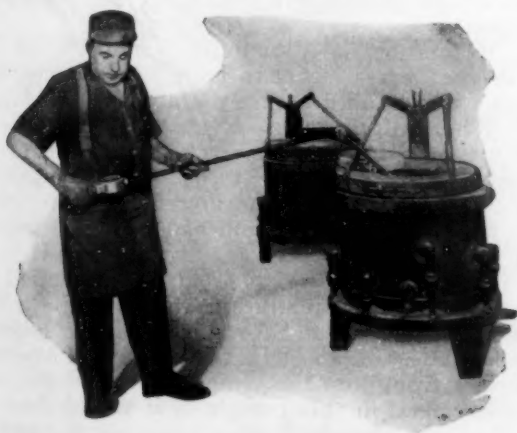
A reasonably priced individual pyrometer on each melting pot or machine will be found a very profitable investment, although due to the very deteriorating action that the zinc and particularly the aluminum alloys have on thermo-couple protection tubes, some firms prefer to use a portable pyrometer for these alloys.

Protection tubes for pyrometer thermo-couples are now obtainable of the same metal of which the pots are made. These offer long and economical life and provide a protection tube that can be left continuously in the metal with the permanently mounted pyrometer.

Pyrometer Practice for the Non-Ferrous Foundry

Whether in smelting, refining, or casting of non-ferrous metals, temperature is a vital factor in economical production.

Too high a melting temperature is injurious to the



Taking Temperature Readings Directly in Furnace

physical properties of the metal, while too high a pouring temperature will not produce sound castings.

Every unnecessary degree of heat wastes just that much fuel. Every cubic foot of gas, every pint of oil, every pound of coke consumed in raising the temperature above the proper degree takes just that much out of profits.

For a long time the only means of measuring the temperature of the metal was the eye of the foundryman. Color conditions caused by the brightness of the day were very misleading, and if losses incurred by improper temperature could be calculated, the amount would undoubtedly be very large.

Aluminum

The pouring temperature of aluminum varies from around 1200° F. to about 1400° F. depending on the alloy and the size and shape of the casting and the arrangement of the gates. As a general rule the melting temperature should be only slightly higher than the pouring temperature.

The temperature drop of aluminum after it leaves the furnace is quite rapid, and the temperature readings must, therefore, be taken quickly.

The type of thermo-couple used for aluminum must be capable of taking readings in a few seconds. Since the bare thermo-couple provides the fastest readings, it is generally used where only aluminum is melted and poured.

Furthermore, as dross is usually a minor factor, the bare wire provides satisfactory readings without being greatly affected by surface conditions.

As the readings are of an intermittent nature—that is, they are taken only at intervals, often not more than two or three of each furnace or crucible, and since these readings may be taken at widely separated places in the furnace room or pouring floor, the pyrometer must of necessity be portable.

Brass, Bronze and Copper

Up to the past two years the use of pyrometers for molten brass, bronze, and copper was less extensive than for molten aluminum.

The chief reason was the fact that prior to 1930 pyrometers for these higher temperature metals were not very satisfactory on account of the thermo-couple difficulties.

Not only was the thermo-couple short lived, but the open thermo-couple (bare wire) gave only a surface reading thus making it impossible to get a reading in the furnace without skimming the metal on account of the slag or glass on the metal used to prevent oxidation.

Phosphor bronze seems to have a far more deteriorating effect on thermo-couples than other non-ferrous metals. This is true either of the open couple or the closed couple.

The introduction of the enclosed or protected type thermo-couples made possible true readings below the surface without the bother of skimming, thus enabling the control of melting temperatures as well as pouring temperatures. Furthermore, the enclosed type couple gives longer life in these high temperatures and provides more economical readings.

A Binder for Everything to Everything

Q.—We want a permanent binding agent that will hold all kinds of stucco to tin, wood, pottery, etc., etc.

A.—Possibly the universal durable binder for everything but fly-paper is Trinidad asphalt. This should be applied hot. It can be thinned with kerosene, and can be thickened with cement, shells, crushed rock, or most any mineral. Dip the articles in the thin solution and dust or roll on any kind of stucco. To color for any requirements, spray or dip in the color solution, and brush on other colors locally over spots or depressions.—**Mechanical Engineer.**

Making Strong Brass and Making Brass Strong

By MICHAEL G. CORSON

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Practical Considerations in Producing Brass Castings and Forgings. Part 2*

Practical Suggestions

With all the facts previously stated taken in consideration we may suggest the following answers to our problem of making brass goods strong:

1. Always have your alloy ingoted. Never pour a brass made directly from copper and zinc into your molds (sand or chills), for it will be too hot, too long in the furnace and too gassy.

2. Know the composition of your ingots. Unless you know well the ratio of your zinc to your copper, you can not tell the maxima of characteristics proper for the alloy.

3. Do not worry about your ingots (if bought outside) containing nickel, iron, tin or aluminum, or manganese, unless you have more than 1% of tin, 0.5% of aluminum, 0.5% iron and 0.5% lead. Simply disregard them when figuring the strength of your castings; (i. e. count them as so much zinc).

4. We know little about the influence of arsenic, phosphorus and antimony upon the properties of cast brasses. Perhaps even large contents of these are not detrimental. Perhaps they are noxious in some indirect way only. Because of this lack of reliable information you must refuse to buy ingots in which the total amount of these three elements exceeds 0.1%.

5. Do not worry about venting your mold. The densest sand is perfectly porous for the air in the mold and dampness in the sand to escape without troubling the casting.

6. Attend religiously to your melting. Do not let one furnace man tend a row of furnaces. This cannot be done efficiently.

7. Do not overload your crucible or reverberatory with ingots. The saving in fuel is nominal, while the danger of the formation of a bridge (under which the molten metal becomes excessively hot and gassy) is a very real one.

8. Try to obtain rapidly a goodly pool of molten metal at the bottom of your crucible and then add your ingots continuously so as to keep the metal always near the freezing point.

9. Use no protectors like charcoal, glass, etc., and use no scavengers or deoxidizers. There is no need to deoxidize brass and it cannot be done anyway. There is no need to scavenge it of anything except gases. Charcoal produces a saturated atmosphere of carbon monoxide. Some persons maintain that this gas is insoluble in copper and brass because it forms no blowholes; no defect you can see. But gas bubbles

can be microscopical, even ultramicroscopical, and they may have the form of thin but effective films. So use no charcoal.

10. There is a prejudice against aluminum in brass. We shall not go here into a complete discussion of the subject. We shall grant that the presence of aluminum oxide may cause troubles in polishing—now and then. But otherwise aluminum is a most beneficial element. It cuts down the evaporation of zinc to next to zero. It increases fluidity, because it inhibits the rapid loss of heat by radiation. It prevents the burning in of the sand and the sticking of the chill mold. A chill mold requires no dressing whatsoever when the poured brass contains as little as 0.1% aluminum.

11. Hence find out if your ingots contain aluminum. This is easy. Just melt a sample with the torch and let it solidify. A clean, golden-colored surface of the button will vouch for the presence of aluminum.

12. If there is no aluminum, add 0.1% of it as soon as your brass starts to melt. It will cut down the loss of zinc and decrease the absorption of gases.

13. When all the charge is molten increase the fire or use more electric current. Heat for three minutes only. This will suffice to boost the temperature by 50° C. You will need no more.

14. Ladle your metal before pouring it into the molds. It is easier to skim the metal when it is in a ladle and it continues to give up the occluded gas.

15. Do not pour directly into the gate. This practice causes churning and for some obscure reason it is detrimental. Get an inclined gateway for the metal and form a trough on the upper surface of the mold. Pour your metal in this trough so it would flow first along the open channel, before touching the inclined gateway and entering the gate. If you have aluminum in the alloy you need not fear that the metal will freeze. On its way to the gate it will lose a lot of gas and perhaps also dispose of mineral dirt as well.

16. Never allow your metal to wait for the molds. The molds should wait for the metal. If you wish to ruin your metal just leave it in the furnace for an hour, even at a low temperature. Gases are absorbed mainly in relation to the time factor and the temperature factor is of little importance.

17. You need not measure the temperature of the metal if it was properly melted. Spare your pyrometer; it may get broken or thrown out of adjustment. However, if you happened to keep your metal too long in the furnace and are too thrifty to reingot

* Part 1 was published in our March issue.

it for the purpose of a more proper melting, pour it into the ladle and keep it there long enough because the escape of the absorbed gases into the atmosphere is also a function of time. But if you worry lest the metal freezes on you (novices always do) use your pyrometer.

18. Do not be too thrifty when buying your ingots. Insist upon a decent surface all over and a shrinkage pipe on the top. Ingots that look worm eaten may give good castings after a couple of remelts, but they are not under obligation to do so, even then.

By adhering to the above rules one can be sure to obtain castings, the average strength of which should not differ by more than 10% from the maxima indicated. The ductility also will not drop by more than 25% of the maximum value. It may be possible to better these figures by using proper designs of the patterns, applying chills to heavy sections, incoming corners, etc. But certainly there is no reason to adopt inferior standards. A casting which shows 35,000 lbs. strength instead of the possible maximum of 45,000 is nothing but a metallic sponge.

Forging of Brasses

Certain articles are made of brass by forging or in general, by the application of hot work—anywhere from 600° to 800° C. In the majority of cases the brasses so used contain from 38 to 44% zinc. Undoubtedly they form materials of excellent forgeability. There is practically no method of shaping in which they would fail when red hot.

Direct forging is however, rarely resorted to. Generally the hot working is limited to die pressing of properly sized stock cut off from hot rolled or extruded material. This forms a domain of the big rolling mill and we need not discuss it here.

For a number of reasons brasses with 34-37% zinc are very rarely used in the wrought shapes. Some of these reasons are relatively valid.

Of the lower brasses almost none is used for working in the hot state. There was a superstition of long standing, that these brasses could not be hot worked. By and by we began to hot roll them, which practice is gaining ground in Germany and England. Then they were subjected to working by extrusion as well. This was a tough proposition since the amount of energy needed exceeded greatly that necessary for extruding a 40% brass for instance. But now it is common practice everywhere.

Just as they are workable by extrusion or hot rolling, these lower brasses are workable by forging. It is strange that work of this kind is rarely if ever performed industrially.

It may be asked—why forge low brasses if they can be spun or stamped from cold rolled stock, or made by casting? It is difficult to provide a proper answer that would carry weight, except as follows.

In comparison with castings, forgings can be made of a decidedly superior strength and hence soundness. In many cases the two processes might be properly combined. Forging could be used to make a casting or its parts considerably more dense.

In comparison with stamping or machining out of rolled stock we can offer one reason as a sort of a hypothesis in favor of forging.

All cold rolled and annealed stock, and articles made of it, fail by shearing. A test bar of a rolled 30%

brass will, for instance, show a nearly straight sloped shear across its whole section.

Contrary to that, a hot forged bar, possessing the same high elongation as an annealed bar, will break in a manner described as a "perfect cone and cup fracture." Also its surface will remain smooth, while that of a cold worked and annealed test bar will show a distinct waviness.

Again, the rigidity of an article of low brass made by cold working increases out of proportion to the work performed. A comparatively slight reduction in cross-section will cause a great drop in ductility and a great increase in the elastic limit. It is easy to bring the strength of a 30% brass from 45,000 lbs. to 85,000 and to regulate it then so as to get 90,000 lbs. at will. But it is difficult to harden this brass just to 50,000 or 55,000 strength.

Quite the contrary is true for forging at a high temperature. Very high rigidity cannot be produced. On the other hand by finishing the forging at a proper temperature the lower and intermediate stages of rigidity can be easily produced and reproduced.

All this may and may not be of industrial importance, but it is worth noting. If someone wants to produce articles of alpha brass by hot forging, the following suggestions may be found helpful.

1. The ingots and billets for forging must be made of virgin metals of good purity, or bought according to analysis.
2. In ingots up to 35% zinc, lead must be absent; above 38% even as much as 2% lead will not do any harm. The reason for this is not known.
3. The addition of aluminum when remelting the ingots is highly desirable, for the same reasons as stated before; also, because an aluminum treated brass oxidizes less when heated previous to or between forgings.
4. Low zinc brass can be forged safely from 550° to 850° C. When hot bending enters as a part of the forming process, this should be done between 650° and 750° C. Above and below this range some cracking may occur.
5. There is no need to anneal a forging, unless one wishes to restore its full ductility. It is far better to finish the forging operation with an intensive hammering at 550° C. If the forge is dark enough, this point will be identified by the dark red glow of the metal.
6. To anneal a forging to a maximum ductility it needs to be heated only a few degrees above the final forging temperature, and for a very short time. For a low zinc brass 15 minutes suffice. Brass with 40-42% zinc requires more time to regain its full ductility. The method of cooling is of little importance for the low brass. With the higher zinc contents quenching may be used to obtain a considerable increase in rigidity. But it should not be done from a temperature higher than 600° C., or the article will be inclined to corrosion by dezincification.

However, annealing, quenching, etc. may be considered as being refinements of little use. While no careful investigations cover this point, it may be safely assumed, that the best way to treat a brass in hot forging is to bring it to 800° C. and work fast, so as to finish the operation (without reheating) at the moment when the forging shows only a dull red glow. Then it can be cooled in air.

This article will be continued in an early issue.—Ed.

British Institute of Metals Meeting

Papers on Aluminum, Cadmium, Tin, Copper and Magnesium Alloys; Soft Solder and Type Metal; Fatigue, Corrosion and Spectrographic Analysis

THE Twenty-Seventh Annual General Meeting of the British Institute of Metals was held in London on March 6 and 7, 1935. The President, Dr. H. Moore, occupied the Chair.

The Secretary presented the Report of Council for the past year.

Beilby Memorial Award

The Council is glad to report that a member, Dr. W. Hume-Rothery, received a Beilby Memorial Award of one hundred guineas.

Election of Officers

The Secretary announced that the Council for the year 1935 had been elected as follows:—

President: Dr. H. Moore.

Past-Presidents: Professor Sir Harold Carpenter, Sir John Dewrance, Sir Henry Fowler, Dr. Richard Seligman, Leonard Sumner, Professor T. Turner.

Vice-President: W. R. Barclay, Dr. C. H. Desch, Dr. A. G. C. Gwyer, Professor D. Hanson, H. C. Lancaster, E. L. Morcom.

Honorary Treasurer: John Fry, London.

Synopses of Papers

Corrosion-Fatigue Properties of Duralumin With and Without Protective Coatings, by I. J. Gerard and H. Sutton.

Rotating cantilever endurance tests on Duralumin 3LI (copper 4.1-4.4, manganese 0.64, magnesium 0.62-0.67, iron 0.84-0.81, silicon 0.22 per cent) have been made in air and in a salt-spray after protecting the surface in various ways. In air the untreated material gave a fatigue limit of stress of ≈ 9.1 tons/in.² at 10^7 cycles and the anodized material ≈ 11.1 tons/in.². In a salt-spray, lanolin-coating and cadmium-plating afforded little protection, but zinc plating gave a substantial improvement in the corrosion-fatigue range. Spraying with aluminum was not so good as zinc-plating at long endurance. Coatings of organic resins and enamels afforded a very high degree of protection, especially when the metal had previously been anodized; the best results were obtained with a coating of synthetic resin varnish and stoving for 2 hrs. at 150°C ., metal so treated giving a fatigue limit stress of ≈ 12.2 tons/in.² at 10^7 cycles.

Some Further Experiments on Atmospheric Action in Fatigue, by H. J. Gough and D. G. Sopwith.

The paper describes experiments carried out to investigate further the effect of atmospheric environment on the fatigue-resistance of metals. Previous experiments, had shown that the substitution of a partial vacuum for the atmosphere led in some metals to a considerable improvement in the values of the fatigue limit determined using cycles of reversed direct stress. Three suggestions have been offered as to the cause of this improvement, namely: (1) that oxygen is the primary factor, the presence of water—as a catalytic agent—also being necessary; (2) that atmospheric impurities, acid and alkaline, are responsible, and (3) that impurities, mainly gaseous, dissolved in the metal under test, react with the metal during fatigue.

To examine possibilities (1) and (2), fatigue tests have been made using copper and brass in four environments, namely, air, partial vacuum, also purified air freed from acid and alkaline impurities) both in the dry and damp conditions. To examine possibility (3) fatigue tests both in air and in a partial vacuum have been made on a copper containing cuprous oxide, on oxygen-free copper, and also on copper deoxidized with phosphorus. As a matter of general interest fatigue tests conducted both in the atmosphere and in a partial vacuum have been made on pure lead, also on Armco iron tested in two forms of heat-treatment.

The results of the tests on copper and brass suggest strongly that the acid and alkaline impurities present in the atmosphere can have little, if any, influence on atmospheric corrosion-fatigue, but that oxygen in the presence of water is probably primarily responsible. The results of the tests on the oxide-bearing and deoxidized coppers show that the comparable behavior of these materials when tested in air and in a partial vacuum is unaffected by the different compositions of the dissolved gases present in the two materials.

The Effect of Five Years' Atmospheric Exposure on the Breaking Load and the Electrical Resistance of Non-Ferrous Wires, by J. C. Hudson.

This paper gives the results of atmospheric corrosion tests in which various non-ferrous wires were exposed to an urban atmosphere for 5 years; the extent of corrosion was measured both by determinations of the extent to which the breaking load of the wires had been decreased by exposure and by measurements of the increase in the electrical resistance of the wire. The results of the two series of tests are in reasonable agreement both with each other and with those of earlier tests. In general, the rate of corrosion observed was small, that of copper being,

for instance, of the order of 0.0002 in. per annum; the rate was definitely higher for nickel, nickel-copper alloys with high nickel contents, zinc, and brass, the breaking load of the last material being appreciably impaired by the effects of "copper redeposition." The most corroded material of all was a galvanized iron wire, which failed rapidly when the zinc coating had corroded. Comparison of the present results with those of similar tests over shorter periods points to the conclusion that in many cases, such as those of copper and high-copper bearing alloys, the rate of corrosion decreases with time of exposure.

The ξ , γ , and β Phases of the System Cadmium-Silver, by P. J. Durrant.

The constitution of the alloys of cadmium and silver from 30 to 60 per cent by weight of silver has been reinvestigated by the methods of thermal and micrographic analysis. The liquidus has been found to consist of four smooth curves intersected by peritectic horizontals at 592°, 640°, and 736°C. The boundaries of the phases ξ , γ , and β have been mapped. No changes occur below the solidus in phases ξ and γ , but the β undergoes two transformations. The upper transformation $\beta \rightleftharpoons \beta'$ occurs at 470°C. when γ is present, at 440°C. when α is present, and at some intermediate temperature dependent on the composition when β alone is present; the lower transformation $\beta' \rightleftharpoons \beta''$ occurs at 230°C., 240°C., or at some intermediate temperature under the same respective conditions. Both of these transformations are associated with marked changes in the range of solid solubility, and with the existence of eutectoid points at which the solid solution decomposes into a characteristic duplex structure of the Widmanstätten type.

The Penetration of Steel by Soft Solder and Other Molten Metals at Temperatures up to 400°C., by L. J. G. van Ewijk.

Investigation of the failure of a nickel-chromium steel axle-tube of an aeroplane showed that the material had been weakened by intercrystalline cracks due to a soft-soldering operation. Experiments were made with test-pieces of a number of steels, by stressing the specimen during exposure to molten metals and alloys at temperatures up to 400°C. Cracking occurred in several of the steels, and microscopic examination showed characteristic intercrystalline penetration by the molten metal. The steels varied in their behavior, certain specimens being particularly sensitive. Tests were made to determine the effects of temperature of the molten metals and treatment of the steel. The nature of the type of attack studied and its practical significance are discussed.

Type Metal Alloys, by Frances D. Weaver.

The microstructure and properties of lead-base antimony-tin-lead "type metal" alloys have been investigated by means of thermal analysis and microexamination. The liquidus surface for alloys containing up to 24 per cent antimony and 14 per cent tin has been constructed.

The general lines of the constitutional diagram put forward by Iwase and Aoki have been confirmed. The existence of a true ternary eutectic in the lead-base corner is confirmed, but with the composition antimony 12, tin 4, and lead 84 per cent, solidifying at 239°C. The ternary peritectic invariant point of Loebe and contemporary workers is shown to be the eutectic point of a pseudo-binary system of lead and the compound SbSn .

A method of etching has been devised which distinguishes between the α and β antimony-tin phases, whether present as primary crystals or as eutectic constituents. The microstructures obtained with different rates of cooling through the solidification temperatures, including those of industrially cast types, have been examined and compared.

Hardness tests have been carried out on the alloys.

The Constitution and Properties of Cadmium-Tin Alloys, by Professor D. Hanson and W. T. Pell-Walpole.

The constitution of cadmium-tin alloys has been determined by means of cooling curves and microstructures. A eutectic is formed at 176°C. and 33 per cent of cadmium, but while there is a solid solubility at either end of the system, the exact positions of the sloping solidus lines have not yet been determined. Above 131°C. tin holds between 5 per cent and 6 per cent of cadmium in solution, but at 131°C. two conjugate solid solutions are formed, which at 127°C. have the compositions 1.25 per cent and 5 per cent of cadmium. At this temperature, the one richer in cadmium decomposes to form a eutectoid. This transition occurs in all compositions from 1.25 per cent to 99.5 per cent of cadmium. In alloys containing 40 per cent to 90 per cent of cadmium, a slight transition, connected with a change of solubility of tin in cadmium, occurs at 170°C.

The tensile strength and hardness of alloys containing up to 10 per cent of cadmium, have been measured after various heat-treatments. A permanent volume of 5 tons/in.² can be obtained after suitable heat-treatments with addition of 5 per cent of cadmium. Cadmium has a very marked refining effect on the grain-size of tin. After a reduction of 80 per cent by rolling, the grain-size is reduced from 1600 grains/cm.² in the case of pure tin, to 26,000 grains/cm.² when 1 per cent of cadmium is present. Further additions have little effect. After annealing for 1 day at 160°C., tin containing 5 per cent of cadmium has a grain-size of 48,000 grains/cm.².

Some Properties of Tin Containing Small Amounts of Aluminum, Manganese or Bismuth, by Professor D. Hanson and E. J. Sandford.

Aluminum.—Aluminum has a large effect on the strength of tin; 0.5 per cent increases the strength of pure tin from about 1.0 to about 5 tons/in.², while the elongation decreases from about 80 to 30 per cent. Further additions, up to 1.0 per cent, produces no appreciable effect. The improved properties are not permanent when the alloys are stored in normal conditions, owing to a deterioration of the material which commences at the surface and spreads slowly inwards: a brittle "skin" is formed, which cracks when the alloy is bent or otherwise strained. The tensile strength is seriously affected in thin sections, and a mass of cracks forms on the surface of the specimens. The "core" remains ductile for long periods. Rolled alloys deteriorate more rapidly than similar alloys in the cast condition, but the latter are not immune.

Manganese.—A method for alloying manganese with tin is described. The effect of manganese on the strength of tin is only slight, and is practically independent of heat-treatment. Manganese is probably soluble in solid tin to only a very small degree at all temperatures. The addition of about 0.10-0.15 per cent of manganese to tin greatly refines the crystal size at all temperatures up to the solidus; the effect of about 0.2 per cent is much less. With manganese

contents exceeding about 0.3 per cent a fine grain is again produced. The slight variations in tensile strength have been correlated to corresponding variations in crystal size.

Bismuth.—Bismuth greatly increases the tensile strength of tin, from about 1.0 ton/in.² in the pure metal to about 4.5 tons/in.² with a bismuth content of 4 or 5 per cent. Heat-treatment has little effect on the strength, but alloys heat-treated near the eutectic temperature have low elongations. An explanation of the mechanical properties is suggested, based on the assumption of certain approximate values for the solid solubility; the values deduced are approximately the same as those given by Cowan, Hiers, and Edwards²⁰. Bismuth has a profound refining effect on the grain-size of tin, producing much finer grain structures than any other alloying element yet investigated: it is particularly effective in restraining grain-growth at elevated temperatures.

The Reduction by Hydrogen of Stannic Oxide Contained in H.-C. Copper, by W. E. Alkins and A. P. C. Hallows.

Samples of H.-C. copper wire, No. 16 s.w.g., containing 0.021 per cent of stannic oxide, SnO₂, were heated in a constant current of hydrogen for periods of 15, 30, 60 and 120 minutes at temperatures increasing from 550° to 850°C., and the tin-oxide content determined after each treatment. The results show that reduction of the stannic oxide commences at about 550°C., and that it is complete after 30 minutes at 850°C. and after 60 minutes at 800°C. Thus, in the case of coppers containing amounts of tin oxide such as are usually encountered, conditions of temperature and time which are satisfactory for determination of "loss in hydrogen" will effect complete reduction of any stannic oxide which may be present.

Unsoundness in Aluminum Sand Castings. Part III.—Solidification in Sand Moulds under Pressure, by Professor D. Hanson, I. G. Slater.

By allowing gassy aluminum-alloy melts to solidify in sand moulds under an extraneous pressure of air or nitrogen, pinholes are reduced in size and ingots

of high density may be obtained. With most aluminum alloys a pressure of 50 lb./in.² is sufficient to remove all visual traces of pinholes from a 2 in. x 2 in. diameter sand-cast block. At higher pressures ingots having densities approaching the optimum are obtained. The applied pressure appears to affect the gas cavities by compressing them to finer dimensions. The mechanical properties of the alloys are much improved by solidification under pressure, whilst shrinkage is confined to a single cavity.

Alloys of Magnesium. Part II.—The Mechanical Properties of Some Wrought Magnesium Alloys, by W. E. Prytherch.

An investigation into the mechanical and rolling properties of some magnesium alloys is described. The alloy systems studied have been selected with reference to their constitution with a view to the production of alloys of good mechanical properties amenable to heat-treatment. Although no alloys have yet been made which respond satisfactorily to heat-treatment in the manner characteristic of certain well-known aluminum alloys, some alloys having interesting properties have been studied.

The Spectrographic Analysis of Aluminum, by D. M. Smith.

Ordinary photographic records of arc and spark spectra of graded series of standard alloys of aluminum with copper, iron, manganese, silicon and titanium have been investigated from the point of view of the establishment of a satisfactory routine method of analysis. The spark gives a steadier and more reproducible source of light and, since adequate sensitivity of detection of the impurities usually occurring in aluminum is obtained, analytical tables have been compiled for use with the spark method. For routine testing of samples an auxiliary alloy of aluminum with 1 per cent nickel is used for the auxiliary spectrum method, but further accuracy of determination would be obtained by direct comparison with suitably selected standard samples. The arc method is more sensitive for the detection of traces of such impurities as lead and gallium.

Welding Copper

Q.—We have been referred to you in regard to methods of forge welding and heat treatment of copper. We would appreciate any information that you could give us on this such as manuals or any other source of information.

A.—Your inquiry covers quite a large order. No one publication gives the whole story, and even a group of reference books, periodicals, and booklets may not satisfy all of your requirements.

Copper of certain qualities can be extruded in various shapes by heating and subjecting it to a heavy pressure. Copper can be welded but it requires expert handling.

In the first place, copper requires a high temperature to fuse it, such as 1,900 to 2,000° F. In the second place, copper is one of the best conductors of heat. Therefore, unless the pieces be small, a large amount of heat must be put into it rapidly and be sustained in order to produce and hold the fusing temperature. In the third place, copper oxidizes considerably when highly heated in contact with the air,

and the oxides so produced greatly reduce the useful properties of the metal.

Cold working makes copper hard and brittle. The use of about 2.25 per cent of beryllium in copper and a heat treatment of 525° F. for about one hour greatly increases the strength and the hardness of copper.

Copper hardened from severe cold working may be annealed to soften by heating to about 1,000° F. and quenching in water. The strength of copper drops greatly when heated above 300° F., but its reduced strength remains fairly constant up to 1,300° or so.

Charcoal and glass make protective coverings when heating and melting copper. Some of the oxides can be cleared out by stirring the metal vigorously with a green wood pole. Some of the heat treating of copper is done in the protection of atmospheres of nitrogen and hydrogen. Details of all these processes must be given careful consideration, and the equipments must be exactly suited to the work in order to insure success.—**Mechanical Engineer.**

Testing Materials Society Meeting

Standardization and Research Work Advanced During A. S. T. M. Committee Week

MUCH progress was made by the A. S. T. M. committees participating in the Group Meetings of Committees held in Philadelphia, March 4 to 8 inclusive. There were about 130 meetings of main committees, sections and subcommittees.

Most of the meetings were unusually well attended, the total registration for the week being 610. The success of the meetings indicates increasing interest in the Society's specifications and research programs.

A large number of proposed standards were offered by the committees and several specifications and test methods which have been in the tentative stage were recommended for adoption as standard. Several new committees will be organized as a result of actions taken by the standing groups in order to undertake research or other work to develop adequate data on which to base needed specification requirements.

The following committees were among those which held meetings with, in the case of most of the standing committees listed, a number of subcommittee meetings:

Committee B-1 on Copper Wire

Committee B-1 on Copper Wire approved for submission to ballot of the whole committee important revisions in the Standard Specifications for Bare Concentric-Lay Copper Cable, Medium, Hard or Soft (B 8-27) which will provide new requirements for testing this type of copper cable. The changes provide for the testing of the cable in its completed form; the present specifications require tests of the individual wires comprising the cable.

A new stranding table for the cable is to be inserted in the specifications. This stranding table seems to have met the approval not only of Committee B-1, but also the I. P. C. E. A.¹ and the Sectional Committee on Insulated Wires and Cables.

The committee received an interesting report of progress from Subcommittee I on Electrical Transmission Wire and Cable Specifications. This report included data resulting from a number of tests on transmission cable for the purpose of investigating the question of soft versus hard wire core in such cables.

The committee also took action to propose tentative additions to the bronze trolley wire specifications to provide requirements covering a higher conductivity trolley wire than the present two classifications of trolley wire. The committee also proposed tentative revisions providing for additional limitations of certain dimensions of grooved trolley wire both bronze and copper.

Officers of Committee B-1 on Copper Wire:

Chairman: J. A. Capp, Engineer of Materials, Works Laboratory, General Electric Company.

Secretary: J. H. Foote, Supervising Engineer, Commonwealth & Southern Corporation.

Committee on Corrosion of Non-Ferrous Metals and Alloys

Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys received interesting reports of its Sub-

committees VI, VII and VIII charged with the responsibility of planning and carrying out tests in the atmosphere in various locations in the United States, and in different liquids.

Plans were completed for displaying corroded specimens at the A. S. T. M. annual meeting and Exhibit in Detroit next June. There will be available at that time a series of atmospheric specimens which has been exposed over a period of one year, and another series which has been exposed for three years. Meteorological data have been carefully kept at the test locations and the weight loss and strength loss of the specimens have been considered in the light of such data.

There will also be available specimens immersed for various lengths of time in sulfuric acid pickle tanks, and an extensive series of galvanic couples exposed to the atmosphere at nine test locations in various parts of the country.

Officers of Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys:

Chairman: T. S. Fuller, Metallurgist, Research Laboratory, General Electric Company.

Secretary: Sam Tour, Vice-President, Lucius Pitkin, Inc.

Committee B-5 on Copper and Copper Alloys

Committee B-5 on Copper and Copper Alloys, Cast and Wrought is continuing its extensive standardization work and three new tentative specifications were proposed. It is anticipated that these may become 1935 tentative standards.

The specifications cover wrought phosphor-bronze bearings and expansion plates for bridges and structures, and silicon-bronze bearings and plates for the same purpose.

The third specification will provide standardized requirements for a copper-silicon alloy wire for general purposes.

It will be recalled that this committee has prepared three specifications which were first published in 1934 as tentative covering various forms of material including sheet, plates, rods, bars and shapes, from copper-silicon alloys.

Officers of Committee B-5 on Copper and Copper Alloys, Cast and Wrought:

Chairman: C. H. Mathewson, Professor of Metallurgy, Yale University.

Secretary: D. K. Crampton, Metallurgist, Chase Brass and Copper Company, Inc.

Specifications for Electroplated Coatings

The work which has been going on for the past three years under the direction of the American Society for Testing Materials, the American Electro-Platers' Society and the National Bureau of Standards has reached the state where specifications on the plated coatings on iron and steel are about ready for approval. About 7,000 panels were exposed, plated in almost every way known to the plating industry and some very important facts were discovered. It was found that the plating usually used was considerably less in thickness

¹The Insulated Power Cable Engineers Association.

than should be required in accordance with the findings of the test.

Further progress was made in completing the specifications before they are finally adopted. Their adoption by industry is a very important matter involving the use of greatly increased materials used in plating such as nickel, copper, zinc and cadmium. Due to increased quality which will result from conformity with the requirements, the use of plated products will probably be increased.

It is expected that the three specifications will be issued shortly. These cover the following: Electrodeposited coatings of nickel and chromium on steel, electrodeposits of zinc on steel, electrodeposits of cadmium on steel. In each of the specifications two types of coating are covered, namely, coating for general service and coating for mild service. The requirements involve manufacture, thickness of deposits, and in one case of nickel and chromium coatings on steel, a continuity test is specified. Methods for thickness measurement are of course given in each of the three specifications.

Appendices to the items give important supplementary information on time required for plating and explanation of symbols used as designations of the grades of plating.

William Phillips presided over a meeting for the discussion of testing electroplated coatings. Several members who are familiar with a special method for one class of deposits, agreed to write out their processes in detail, submit them to each member of the Committee, and have them ready for discussion at the June meeting. Considerable interest was shown in the measuring of the thickness of electrodeposited coatings with a microscope. Carl E. Heussner, of the Chrysler Corporation, will submit a report on this method.

From the discussion and the deep interest shown, it is certain that specifications for electroplate deposited coatings are necessary and will be adopted. This will be a fitting recognition of the research work sponsored and supported by the American Electroplaters' Society.

Officers of the Joint Committee on Specifications for Electroplated Coatings:

Chairman: W. M. Phillips, Works Managers Committee, General Motors Corporation.

Secretary: William Blum, Chemist, National Bureau of Standards.

New Committee on Properties of Metals at Low Temperatures

A new Committee on Properties of Metals at Low Temperatures was organized. This is to be a subcommittee of the Joint Committee on Effect of Temperature on the Properties of Metals.

For the purpose of its work, the committee has defined low temperatures as any below room temperature, that is, 70°F. This subject is of great interest to many branches of industry, because of the subnormal temperatures at which equipment must work, such as railroad equipment in northern climates, airplanes flying at high altitudes, in the liquefaction of gases, dewaxing of oils, etc.

The committee will send out immediately a questionnaire to elicit information on what test and research work has been done, the type and nature of such tests with results and also what particular phases

of the problem are of most immediate interest to industry.

A bibliography is to be prepared and a general program of work will be presented for the consideration of the joint committee at its next session during the A. S. T. M. annual meeting in Detroit in June.

Specifications for Zinc Coating of Iron and Steel

The Sectional Committee on Specifications for Zinc Coating of Iron and Steel functions under the procedure of the American Standards Association for the purpose of considering national uniform specifications for the adequate protective coating of different classes of zinc-coated products for approval as American standards or American tentative standards, with the ASTM as sponsor. The committee at its meeting gave consideration to several existing specifications for zinc-coated materials and approved for submission to letter ballot of the committee the following ASTM specifications which, if approved, will be submitted to the ASA for approval as American tentative standards:

Standard Specifications for:

Zinc-Coated (Galvanized) Iron or Steel Telephone and Telegraph Line Wire (A 111-33)

Zinc-Coated (Galvanized) Iron or Steel Tie Wires (A 112-33)

Zinc-Coated Iron or Steel Chain-Link Fence Fabric Galvanized After Weaving (A 117-33)

Zinc-Coated (Galvanized) Iron or Steel Wire Strand (Cable) (A 122-33)

Tentative Specifications for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses (A 120-34 T)

The first four specifications cover various types of galvanized wire and wire products and were prepared by the ASTM Committee A-5 on Corrosion of Iron and Steel. The specifications for galvanized steel pipe, which cover pipe for ordinary uses such as low-pressure service in steam, water and gas lines, were developed by the ASTM Committee A-1 on Steel. The galvanizing requirements of these specifications were prepared in cooperation with Committee A-5 and the sectional committee.

Officers of Sectional Committee on Specifications for Zinc Coating of Iron and Steel:

Chairman: J. A. Capp, Engineer of Materials, Works Laboratory, General Electric Co.

Secretary: A. B. Campbell, Engineer, Edison Electric Institute.

Drilling Glazed Pottery Ware

Q.—We are attempting to drill holes through glazed pottery ware by means of a three-cornered file sharpened to a cutting edge and lubricated with turpentine. This drill does not stand up under this punishment, and we have to sharpen it frequently, entailing a very slow job. Where can we get suitable drills?

A.—It might be a good plan to try high-speed steel drills for this work. Try those manufactured by the Cleveland Twist Drill Co., of Cleveland, Ohio, or those made by numerous other reliable firms. However, we suggest that you go the limit and use cemented carbide of tungsten that is close to the diamond in hardness. These tools drill glass and other very difficult materials successfully. The cost of the drill is higher than for a file, but the cost per hole may be less.

—Mechanical Engineer.

Why Metals Stain the Skin

By C. M. HOKE

Consulting Chemist, the Jewelers Technical Advice Company, New York, N. Y.

The Effects on the Skin of the Different Alloys Now in Use for Jewelry of Various Grades

IT HAS long been known that the metals used in jewelry have different effects upon the skin of different people. The exact causes and full details of these effects have not been worked out; but enough is known to be of interest both to the manufacturer of jewelry and the jewelry wearer. The recent addition of white gold, chromium plate, rhodium plate and aluminum, to the metals used in jewelry, lends further interest to the subject.

Apparently there are three main factors in the darkening or injuring the skin by jewelry—the composition of the article; the character of the perspiration; and the length of time since the article was cleaned.

Let us consider the last factor first. Cheap novelty jewelry—brass and nickel-silver trinkets that sell for a dollar or less—are sometimes lightly gold-plated, and generally lacquered, but both these finishes soon wear off, and as a result the base metal is in close contact with the skin.

Now, if you rub the trinket well with a bit of soft chamois, just before putting it on, it will not be apt to discolor the skin. Otherwise there may be a dark streak within two or three hours. The chamois should be used at every wearing, and at every wearing there will be a dark mark on the chamois. The moral is: even cheap metals, if freshly cleaned, are not apt to discolor the skin.

By the same token high grade jewelry, if long unused, is apt to stain.

Coming now to the composition of the alloy: Ordinary 14-k yellow gold consists of 14/24ths fine gold, plus 10/24ths other metal, of which about half is silver, half copper. With green gold the proportion of silver is higher than that of copper. With white gold there is probably considerable nickel, some zinc, maybe some palladium, and correspondingly less copper, with little or no silver. In 10-k gold there are only 10/24ths fine gold, with 14/24ths base metal—in other words, more than half of the 10-k article is tarnishable metal, and almost half of the 14-k article is tarnishable metal.

The gold molecules do not tarnish at all, except under most exceptional conditions. The copper molecules that are exposed to air promptly form a black oxide; you remember how soon your bright new penny turns dark. If sulphur is present, a black sulphide is formed.

Silver rarely forms an oxide, but if even a little sulphur is present, the black sulphide will soon be visible; you remember the effect of eggs or of a rubber band (substances containing sulphur in small amounts) on a silver spoon.

Suppose we leave a good quality solid gold necklace unused for a few days. Its surface is a mosaic of molecules—gold, copper, silver, perhaps nickel and zinc. Also more or less copper oxide, nickel oxide, and silver sulphide, all three of which are black. The more base metal, the more blackness. Therefore the cheaper the article the more blackness.

Let us put the necklace on. This exposes it to rubbing, also to perspiration. Perspiration contains chlorides, possibly sulphates, sulphides, etc.; if acid in its reaction, that means hydrochloric acid; if alkaline it contains ammonia or substances related to ammonia.

Now, copper and nickel oxides both dissolve in this acid and in ammonia to give bluish solutions. Hence a bluish or greenish streak on the skin. In the loosening of the oxides, the black silver sulphide is dislodged; hence a dark streak.

People differ. Apparently the more acid the perspiration, and the more copious, the greater the darkening. Also, the more sulphur the more darkening, in less time.

Does Chromium Irritate the Skin?

Dr. Logan Clendening, the well known writer on medical topics, reports that in recent years physicians have noted many cases of skin eruptions that seemed to be due to white gold spectacle frames, white gold wrist watches, and the like. Some observers placed the blame on the nickel used as an alloy in the white gold. However, this writer believes that the ailment was caused by chromium, used as a chromium plating, instead. This is a matter of some importance to jewelry, watch case, and spectacle frame makers, and it is hoped that the matter may soon be settled by a little scientific study. Meanwhile, we may note a few facts already obvious.

Chromium plating is common these days, both on expensive and cheap white gold jewelry; also on novelties that are meant to imitate platinum or white gold. Chromium dissolves fairly readily in hydrochloric acid, which is found in perspiration, and the resulting chromium salt may be expected to irritate the skin. Nickel plated articles have been used in contact with the skin for many years; there have been instances of irritation, but not many. Chromium plating is comparatively new, but instances of irritation have been numerous ever since it became popular. Nickel is a component of many white golds, but never a major one. The chromium plate used on white gold articles has practically the same color as white gold, and the layman would probably not recognize its presence.

We know of one case where a patient's wrist was made sore after a few days' use of a chromium-plated wrist watch. He had the case rhodium-plated and the ailment cleared up. In another case the rhodium was almost as bad as chromium, (was this because the rhodium plate was too thin?) while an old-fashioned nickel-plated case was perfectly comfortable.

Some Unusual Cases

In the above we have discussed only normal cases; here are a few cases that may be called abnormal, or at least unusual.

The use of sulphur ointments or sulphur soaps will usually be followed shortly by a dark streak under each gold ring. Copper and silver sulphides have been formed, and have rubbed off.

Depilatories containing barium sulphide are especially efficient in darkening a good many metals.

Mercury ointments and bichloride of mercury rinses will also attack gold. A film of gold-mercury amalgam forms on the surface; this rubs off, darkening the skin. If a gold article is exposed to much mercury it will finally be so softened as to go to pieces.

Here is a curious story that should interest the jeweler: As we know, platinum is not supposed to darken the skin at all. Well, once there was a jeweler

who made a platinum necklace for his wife, and she found that it darkened her neck. He was mystified; he knew it was platinum, not only because of the integrity of its source, but also because he had worked the metal with his own hands, and its characteristics are unmistakable.

He could not believe his eyes. He knew that even the solder used was not solder in the ordinary sense, but pure soft platinum, welded to the hard platinum with an oxygen flame. But there on his wife's neck, after a few hour's wear, was a dark streak.

Incidentally, in describing the case he said that his wife darkened the metal; that is the way a jeweler phrases it, while the layman says that the jewelry darkens the person. As we shall see, the jeweler's phrase is more exact.

Finally he was asked: "Has your wife any ailment of the thyroid gland, and is she taking medicine for that condition?" His surprise was great, for that was the case; the medicine contained iodine, which presumably had appeared in the perspiration as hydriodic acid, one of the few substances that discolors platinum. The black platinum iodide had rubbed off on the skin as a dark streak. Until this and similar problems can be attacked scientifically, we shall have to accept this as the probable explanation.

Various Colored Brass Mixtures

Q.—One of our customers is interested in knowing the composition of brass castings used in ornamental work to match first, extruded shapes; second, drawn and rolled shapes; third, rolled and drawn sections made from sheet metal.

They further inquire what acid or other mixture may be used where two sections abut, in order to tone down or harmonize the color where they differ.

A.—Regarding the composition of brass castings used in ornamental work to match first, extruded shapes:

This metal is hot processed in manufacturing; the alloy used generally is 60 copper—40 zinc.

Second and third: drawn and rolled shapes and rolled and draw sections made from sheet metal:

These items would come under the same classification—drawing brass. Roughly three alloys cover the group of yellow brass, used for drawing, etc. The copper and zinc contents are as follows: 64-36; 66 2/3-33 1/3 and 70-30; known to the trade as common high brass, drawing brass and tubing.

The selection of any one of this group by the fabricator would be governed by the necessary punishment the sheet brass would receive in drawing or forming the shape required. If severe distortion is necessary the alloy with the highest copper contents would be used; if mild or medium, one of the other two would be selected. This class of metal is manufactured by a cold rolling process.

It is obvious that the composition of the cast brass parts would have to be governed by a knowledge of what quality of wrought brass it was to match. It is well to state that a piece of cast brass matched with

a piece of rolled brass of exactly the same alloy will show a difference in color, owing to the denser surface of the rolled brass, but will not be in violent discord. We know of no acid or mixture that would harmonize the color of the extruded brass with the drawn brass.—**Brass Roller.**

Gold from Old Plating Solutions

Q.—I wish to recover the gold from an alloy plating solution, containing gold, copper, and nickel.

We tried zinc, directly to the cyanide solution but got no precipitate. I tried acidifying with sulphuric, also added oxalic acid, while copper and nickel precipitated out. I dissolved this with nitric acid and did not find any trace of gold. Please advise me.

A.—First let us remind you that it is very dangerous to add any acid to a cyanide solution. The fumes produced are extremely poisonous.

As to the reason why no gold precipitated when you added zinc:

(a) Possibly there was no gold there—or so little as to escape notice. An old bath will often be depleted.

(b) Possibly you did not leave the zinc in long enough. You are advised to use zinc shavings, or coarsely granulated zinc—not sheet nor rod. Zinc shavings present considerable surface and usually do the work within a few hours, especially if the solution is stirred often, or kept in a warm place. Zinc sheet or rod will work much more slowly.

Before discarding this old solution we suggest that you test it for possible gold content.

—**Jewelry Metallurgist.**

Electrochemists at New Orleans

Special Session on Electrochemistry and Plating

THE Electrochemical Society held its Sixty-seventh Meeting at New Orleans at the Hotel Roosevelt, March 21, 22 and 23, 1935.

A special session was devoted to papers on electroplating, and Dr. H. S. Lukens was in charge. The metals discussed were zinc and its alloys and chromium.

Officers of the Society

The new officers of the Society, elected for 1935 are:
President, James H. Critchett, Vice Pres., Union Carbide & Carbon Research Labs., Inc., Room 1802, 30 East 42nd St., New York City.

Past President, Hiram S. Lukens, University of Pennsylvania, Philadelphia.

Treasurer, Robert M. Burns, 463 West Street, New York City.

Secretary, Colin G. Fink, Columbia University, New York City.

The Electrodeposition Division

Chairman, W. W. McCord, Research Engineer, McCord Radiator & Manufacturing Company, Detroit, Michigan.

Vice Chairman, Leon R. Westbrook, Research Chemist, Grasselli Chemical Company, Cleveland, Ohio.

Sec'y.-Treas., Gustaf Soderberg, Research Chemist, The Udylyte Company, Detroit, Michigan.

Papers Read

THE DETERMINATION OF TRIVALENT CHROMIUM IN CHROMIC ACID AND IN CHROMIUM PLATING BATHS

By HOBART H. WILLARD AND PHILENA YOUNG

Trivalent chromium in chromium plating baths may be determined by oxidation with excess of standard ceric sulfate and titration of the excess with standard sodium nitrite in the presence of the large amount of chromic acid always present. The end point is determined potentiometrically. Moderate amounts of iron, manganese or other common metals cause no interference. The method is much more rapid and accurate than procedures in use at the present time. The same method may be applied in the determination of the percentage of trivalent chromium in chromic acid.

SOLUTION RATES OF ZINC ELECTRODES IN ACID SOLUTIONS

By H. MOUQUIN AND W. A. STEITZ

The effect of externally imposed potentials on the rate of solution of zinc anodes in acids has been studied under controlled conditions. A minimum rate is observed which is substantially identical for acids of widely differing degrees of ionization. Electro-static attraction is suggested as an important rate-controlling factor in these experiments.

STUDIES IN ZINC ELECTRODEPOSITION: DEPOSITION FROM AMMONIUM-SULFATE-ZINC BATHS

By RAYMOND R. ROGERS AND EDGAR BLOOM, JR.

Baths produced by combining zinc sulfate, zinc ox-

ide, sulfuric acid, ammonium sulfate and ammonium hydroxide, were investigated to determine the range of compositions from which zinc metal may be electrodeposited. This range is plotted on a ternary diagram using NH_4 , SO_4 , and Zn as the variables. The effect of current density and temperature on the appearance of the deposits was investigated.

A FURTHER STUDY OF CYANIDE ZINC PLATING BATHS USING Al-Hg-Zn ANODES

By A. KENNETH GRAHAM

From 1.0 to 0.56N zinc cyanide baths containing from 3 to 7 oz./gal. (22.5 to 52.5 g./L.) sodium hydroxide are studied with respect to **cathode** efficiencies and character of deposits at 20, 40 and 60 amp./sq. ft. (2.2, 4.4 and 6.6 amp./dm.²) and 110° F. (43° C.) Using Al-Hg-Zn anodes,⁴ excellent deposits are obtained at all current densities with bath compositions other than those which have previously been shown to give the most ideal **anode** behavior. The variation of **cathode** efficiency with time of plating, bath composition, solution concentration and current density is noted.

CADMIUM-ZINC ALLOY PLATING FROM ACID SULFATE SOLUTIONS

By COLIN G. FINK AND C. B. F. YOUNG

The main purpose of the present investigation was to study the possibility of utilizing a mineral acid bath for the deposition of cadmium-zinc alloys. We con-

concentrated our attention on the sulfate bath. It is very much cheaper and, above all, more stable than the poisonous cyanide baths now employed. This investigation led to a study of the fundamental principles governing the deposition of alloys from acid sulfate solutions. The effect of temperature, current density, hydrogen ion concentration, total and relative metal ion concentration, addition salts, addition agents, and agitation was carefully investigated. It was found that: (1) Circulation of the bath rotation of the cathode increases the cadmium content in the cadmium-zinc alloy deposit; (2) Increasing the temperature of the bath increases the cadmium content of the alloy deposit; (3) Increasing the cathode current density increases the zinc content of the alloy deposit; (4) Increasing the acid content of the bath increases the zinc content of the alloy; (5) Addition salts, such as $\text{Al}_2(\text{SO}_4)_3$, increase the zinc content of the alloy; (6) Addition agents, such as caffeine, increase the zinc content of the alloy. A new principle as to the selective effect of addition agents was discovered. There is a specific action of certain addition agents on cadmium and not on zinc, nor on copper. This selective behavior appears of general application in the plating of alloys. The result may be due to either the compounds uniting chemically with the cadmium and retarding its migration or to compounds acting as a

diaphragm and preferentially retarding the cadmium ions, or to a combination of both effects. Electrodeposited Cd-Zn alloys composed of 45-55 per cent of zinc and 55-45 per cent of cadmium were most resistant to the attack of NaCl solutions.

THE ELECTRODEPOSITION OF COPPER, NICKEL AND ZINC ALLOYS FROM CYANIDE SOLUTION

Part II: Discussion of the Results in Part I.

By CHARLES L. FAUST AND GEO. H. MONTILLON

The results obtained from the cyanide plating baths given in Part I are discussed from the standpoint of the cathode process and the effect of the relative concentrations of copper, nickel and zinc ions supplied to this process. The extent of ionization of the metallo cyanide complexes is a more controlling influence on the relative metal ion concentration at the cathode than are the relative rates of ion diffusion. The instability of the complex nickel cyanide ion in these baths appears to be less than that of the zinc cyanide complex ion and greater than that of the copper cyanide complex ion. The complex zinc cyanide ion appears to have a maximum dissociation constant at about 25° C.; the complex nickel cyanide ion at about 50° C.; and the copper cyanide ion at some temperature above 70° C.

After Treatment of Non-Ferrous Welds

By A. EYLES

Mechanical Engineer

EXPERIENCE in modern welding technique proves that mechanical treatment by hammering the welded areas of most non-ferrous metals is very beneficial and should always be done where possible. A welded copper joint, for example, is composed of cast copper, and therefore has only the strength of cast copper (24,000 lbs. per sq. in.), but its tenacity can be increased by cold hammering over the area of the weld. After the hammering operation annealing for about half an hour at a temperature of from 1,000° to 1,300° F. is essential. This treatment relieves the strains set up within the metal during welding.

It is also beneficial to hammer welds in aluminum whenever practicable. Hammering tends to relieve the contraction stresses set up during the cooling of the weld and adjacent areas. Hammering may not be sufficient to break down the cast structure in the weld completely, but it will tend to produce a more nearly uniform condition throughout the line of the weld. Hammering will also help to obliterate any surface porosity that may be present in the weld joint. Judicious hammering with smooth bright tools will render fusion welds in aluminum sheet and plate difficult to detect, and most of the buckling produced by fusion welding thin aluminum sheet can be straightened out by hammering on suitable tools. Fusion welds in aluminum bronze may be hammered either cold or hot.

With the forgeable aluminum alloy duralumin, it is necessary to hammer the welded areas whenever practicable and normalize the entire welded job. When no heat treating is practicable the weld should be

allowed to cool slowly, but a weld joint of the strength obtainable with correct heat treatment cannot be expected. Welds in duralumin which are not heat treated show an average tensile strength of only 24,000 lbs. per sq. in., whereas properly heat treated welds in this well known aluminum alloy show an average tensile strength of 42,000 lbs. per sq. in. The buckling and warping of welds in DOWMETAL (magnesium-base alloy) can usually be straightened out in sheets and plates by judicious hammering after annealing the welded job to 650° F. In the magnesium-base alloy Elektron, the best results are invariably obtained by hammering the welds and nearby areas at about 500° F.

Hammering the welds of brass improves the mechanical properties of the metal considerably. It should be done cold for brass containing 62 to 68 per cent of copper, and hot for brass containing 58 to 62 per cent of copper; in the latter case, care should be taken not to hammer the metal below a temperature of 930° F., because at this temperature the metal becomes very brittle. After hammering the welded areas, the metal should be annealed. For the majority of commercial brasses, a suitable annealing temperature lies in the region of 600° C. (1,112° F.) and temperatures between this and 650° C. (1,202° F.) adequately cover the annealing requirements of brass welds. Annealing at higher temperatures than these results not only in wastage of fuel, but also in scaling losses and impairment of the physical properties of the welded product.

A Plater's Guide to Solution Concentrations

By HAROLD W. FAINT

The Udyllite Company, New York City

A Full Explanation and a Quick Reference Table for the Practical Plater

MANY platers are confused by the many ways in which the strengths of solutions are expressed. They all are familiar with the term, ounces per gallon. Some understand the meanings of other terms, but few of them have handy a group of conversion factors to convert these concentrations from one type to another.

The following terms are used to express the strengths or concentrations of solutions:

- 1—Avoirdupois ounces per gallon of solution, oz. av./gal. or simply oz./gal.
- 2—Troy ounces per gallon of solution, oz. t./gal.
- 3—Grams per liter of solution, g./l.
- 4—Per cent by weight, % by wt.
- 5—Per cent by volume, % by vol.
- 6—Normal solutions, N.
- 7—Molar solutions, M.
- 8—Avoirdupois ounces per gallon of water.
- 9—Troy ounces per gallon of water.
- 10—Grams per liter of water.

The first term avoirdupois ounce per gallon is most commonly used in the industry. It should be noted here that the expression does not mean the same thing in England and Canada as in the United States. The Imperial gallon used in the former countries is equal to 1.201 U. S. Gallons and therefore 1 oz./Imp. gal = .83 oz./U. S. gal. = 6.25 grams/liter.

The troy ounce is larger than the avoirdupois ounce. The oz. t./gal. is used to express concentration of precious metals or metal compounds, such as silver and gold. 1 oz. t./gal. = 1.097 oz. av./gal. = 8.2 grams per liter.

Grams per liter is used in scientific work and in commercial work in Europe. As 1 oz. av. = 28.35 grams and 1 gallon = 3.785 liter, 1 oz. av./gal. = 7.5 grams/liter and 1 gram liter = .134 oz./gal.

The expression per cent by weight denotes the number of unit weights of a substance present per 100 unit weights of solution. In order to convert such an expression to oz./gal. one must know the specific gravity of the particular solution in question. A water solution containing 20% by weight sodium chloride has a specific gravity 1.1478, i.e. 1 liter of the solution weighs 1147.8 grams. Twenty per cent of 1147.8 equals 229.56 grams and the solution contains 229.56

grams/liter or $\frac{229.56}{7.5} = 31.06$ oz. av./gal.

A 4% solution of sodium chloride has a specific gravity of 1.0268 and contains $.04 \times 1026.8 = 41.07$ grams/liter = 5.5 oz./gal.

Per cent by volume is used to express the concentration of a liquid which has been mixed with another liquid such as water. A 10 per cent by volume solution of sulphuric acid contains 10 volumes of con-

centrated 96% acid per volume of mixed solution. As the specific gravity of 96% sulphuric acid is 1.84, a 10% by volume solution contains $.96 \times 18 \times 4 = 17 \times 7$

grams per liter or $\frac{177}{7.5} = 24.6$ oz. av./gal.

The terms molar and normal solutions are used by the chemist. One molecule of hydrochloric acid, HCl, reacts with one molecule silver nitrate, AgNO₃ to give one molecule of silver chloride AgCl and one molecule of nitric acid HNO₃. The molecular weight of hydrochloric acid is 36.46 and that of silver nitrate 169.89. Thus 36.46 grams of hydrochloric acid (100% gas, not concentrated solution) will react with exactly 169.89 grams of silver nitrate to give 143.34 grams of silver chloride and 63.02 grams nitric acid. A solution of 36.46 grams/liter of hydrochloric acid is called a one molar solution of hydrochloric acid. 10 ml. of this solution will give a complete reaction with 10 ml. of a one molar solution of silver nitrate containing 169.89 grams/liter or with 100 ml. of 1/10 molar solution containing 16.989 grams silver nitrate per liter. A molar solution contains as many grams of substance per liter of solution as indicated by the molecular weight.

Actually reactions in water solutions take place between the ions of the salts and not between the molecules. Each salt consists of two or several ions. Hydrochloric acid consists of a hydrogen ion and a chloride ion, sodium sulphate of two sodium ions and one sulphate ion, etc. An ion which combines with one hydrogen ion has a valence of 1, for example chloride. The sulphate ion combines with two hydrogen ions to sulphuric acid and has a valence of two. As one copper ion combines with one sulphate ion, its valence is also two. Aluminum combines with three chloride ions to form aluminum chloride and because the chloride ion has a valence of one, aluminum has a valence of three.

A 1-normal solution contains as many grams of substance per liter of solution as indicated by its molecular weight, divided by the valence of the principal ion. For example, the molecular weight of aluminum chloride, AlCl₃, is 133.34. A 1-normal solution contains $\frac{1}{3} \times 133.34 = 44.45$ grams/liter of AlCl₃. A $\frac{1}{2}$ N. solution contains half as much or 22.22 grams/liter, a .1 N. solution 4.45 grams/liter. Equal volumes of solutions of equal normalities always balance each other.

It should be noted that few chemicals have such a constant composition that normal solutions can be made by weighing alone. Before they are used for close analytical work, they must be standardized by the chemist.

The last three expressions on our list, avoirdupois

ounces and troy ounces per gallon of water and grams per liter of water are commonly used to designate solubilities of substances. They cannot be translated into oz. per gallon of solution etc. because each salt causes different expansion or concentration of the water in which it is dissolved. Chemical analysis gives results which can be expressed in grams per liter of solution, oz./gal. of solution, normality etc.,

but never in grams per liter of water or oz./gal. of water. It is therefore preferable to make up solutions on the former basis so that they can be checked easily.

The following table shows the relation between the molarity, normality and concentrations in grams per liter and ounces avoirdupois per gallon for substances commonly used in plating and in the control of plating solutions.

Formula		Molecular weight	Valence	A 1-molar solution contains grams/lit. oz./gal		A 1-normal solution contains grams/lit. oz./gal	
Acid copper solutions							
1. Copper (cupric)	Cu	63.57	2	63.57	8.5	31.79	4.3
2. Copper sulphate	CuSO ₄ ·5H ₂ O	249.71	2	249.71	33.4	124.86	16.7
3. Sulphuric acid	H ₂ SO ₄	98.08	2	98.08	13.1	49.04	6.6
Cyanide copper solutions							
1. Copper (cuprous)	Cu	63.57	1	63.57	8.5	63.57	8.5
2. Copper cyanide	Cu ₂ (CN) ₂	179.16	1	179.16	24.0	179.16	24.0
3. Copper carbonate	Cu ₂ (OH) ₂ CO ₃	221.16	2	221.16	29.6	110.58	14.8
4. Sodium cyanide	NaCN	49.01	1	49.01	6.6	49.01	6.6
5. Sodium carbonate	Na ₂ CO ₃ ·10H ₂ O	286.15	1	286.15	38.3	286.15	38.3
6. Sodium thio sulphate (hypo)	Na ₂ S ₂ O ₃ ·5H ₂ O	248.19	2	248.19	33.2	124.10	16.6
Nickel plating solutions							
1. Nickel	Ni	58.69	2	58.69	7.9	29.35	3.9
2. Single nickel salts	NiSO ₄ ·6H ₂ O	262.84	2	262.84	35.2	131.42	17.6
3. Double nickel salts	Ni(NH ₄) ₂ (SO ₄) ₂ ·6H ₂ O	394.98	2	394.98	52.8	197.49	26.4
4. Nickel carbonate, basic	2NiCO ₃ ·3Ni(OH) ₂ ·4H ₂ O	587.56	2			48.96	6.5
5. Nickel chloride	NiCl ₂ ·6H ₂ O	237.70	2	237.70	31.8	118.85	15.9
6. Ammonium chloride (sal ammoniac)	NH ₄ Cl	53.50	1	53.50	7.2	53.50	7.2
7. Sodium chloride	NaCl	58.45	1	58.45	7.8	58.45	7.8
8. Sodium sulphate	Na ₂ SO ₄ ·10H ₂ O	322.21	2	322.21	43.1	161.11	21.6
9. Sodium sulphate, anhydrous	Na ₂ SO ₄	142.05	2	142.05	19.0	71.03	9.5
10. Epsom salt	MgSO ₄ ·7H ₂ O	246.49	2	246.49	33.0	123.25	16.5
11. Boric acid	H ₃ BO ₃	61.84	3	61.84	8.3	20.61	2.8
Acid zinc solutions							
1. Zinc	Zn	65.38	2	65.38	8.7	32.69	4.4
2. Zinc sulphate	ZnSO ₄ ·7H ₂ O	287.55	2	287.55	38.4	143.78	19.2
Cyanide zinc solutions							
1. Zinc	Zn	65.38	2	65.38	8.7	32.69	4.4
2. Zinc cyanide	Zn(CN) ₂	117.40	2	117.40	15.7	58.70	7.9
3. Sodium hydroxide (caustic soda)	NaOH	40.00	1	40.00	5.4	40.00	5.4
Cyanide cadmium solutions							
1. Cadmium	Cd	112.41	2	112.41	15.0	56.21	7.5
2. Cadmium oxide	CdO	128.41	2	128.41	17.2	64.21	8.6
Alkaline tin solutions							
1. Tin (stannic)	Sn	118.70	4	118.70	15.9	29.68	3.9
2. Sodium stannate	Na ₂ SnO ₃ ·3H ₂ O	266.74	4	266.74	35.7	66.69	8.9
3. Tin chloride (stannous)	SnCl ₂ ·2H ₂ O	225.65	2	225.65	30.2	112.83	15.1
Chromium solutions							
1. Chromium	Cr	52.01	6	52.01	7.0	8.67	1.2
2. Chromic acid	CrO ₃	100.01	6	100.01	13.4	16.67	2.2
Silver plating solutions							
1. Silver	Ag	107.88	1	107.88	*13.2	107.88	*13.2
2. Silver cyanide	AgCN	133.89	1	133.89	*16.3	133.89	*16.3
3. Mercuric chloride	HgCl ₂	271.52	2	271.52	36.3	135.76	18.2
4. Mercuric oxide	HgO	216.61	2	216.61	29.0	108.31	14.5
Gold plating solutions							
1. Gold (aurous)	Au	197.20	1	197.20	*24.1	197.20	*24.1
2. Gold cyanide (aurous)	AuCN	223.21	1	223.21	*27.2	223.21	*27.2
3. Chlorauric acid	HAuCl ₄ ·4H ₂ O	412.10	3	412.10	*50.3	137.37	*16.8
Chemicals used in control							
1. Hydrochloric acid	HCl	36.46	1	36.46	4.9	36.46	4.9
2. Nitric acid	HNO ₃	63.02	1	63.02	8.4	63.02	8.4
3. Sodium bicarbonate	NaHCO ₃	84.00	2	84.00	11.2	42.00	5.6
4. Silver nitrate	AgNO ₃	169.89	1	169.89	22.7	169.89	22.7
5. Potassium ferrocyanide	K ₄ Fe(CN) ₆ ·3H ₂ O	422.33	4	422.33	56.5	105.58	14.1
6. Sodium thio cyanate	NaCNS	81.07	1	81.07	10.9	81.07	10.9
7. Barium chloride	BaCl ₂ ·2H ₂ O	244.31	2	244.31	32.7	122.16	16.4

*troy ounces.

Dropping Tests for Electroplates

By R. O. HULL and P. W. C. STRAUSSER

Grasselli Chemical Company, Cleveland, O., and National
Bureau of Standards, Washington, D. C., Respectively

Methods of Measuring the Local Thickness of Cadmium and Zinc Coatings on Steel*

IN RECENT specifications for the quality of electroplated coatings, greater emphasis has been laid upon the minimum than upon the average thickness of the deposits. This criterion is especially justified in connection with electroplated coatings of zinc and cadmium, the protective value of which depends principally upon their thickness. Rapid reliable methods for measuring the local thickness of such coatings are essential to the application of specifications for minimum thickness.

The purpose of this paper is to describe methods for measuring the local thickness of cadmium and zinc coatings on steel. It is hoped that these methods will be given a thorough trial, so that, if satisfactory, they may be incorporated in specifications that are now under consideration.

Principle of the Methods

The proposed methods depend upon the rate of solution of the coating by a suitable reagent. Much the same principle is involved in the Preece test for zinc coatings, which involves immersion in a copper sulphate solution until adherent copper is deposited where the zinc coating is thinnest. Experience with the Preece test and with other immersion tests (including those using ammonium nitrate solutions) has shown that while they are valuable for detecting lack of uniformity of thickness, the time required to produce the endpoint is not always an accurate measure of the minimum thickness.

More consistent results are obtained with methods in which fresh reagent is continuously supplied to the surface. A "dropping method" for cadmium was described by S. G. Clark¹, who allowed an aqueous iodine solution (100 g/l of iodine and 200 g/l of potassium iodide) to drop at a specified rate (one drop per second) upon the surface to be tested, until the steel was exposed. He found that under these conditions, 18 drops were required for each 0.0001 inch of cadmium. Experiments by one of the authors (P. W. C. Strausser) have confirmed this rate for cadmium coatings, and have shown that with the same solution and conditions, 22 drops are required for each 0.0001 inch of zinc coating. Possible objections to this method are the relatively high cost of the iodine solution if many tests are performed, the irritating odor of the iodine fumes from the vessel into which the solution runs, and the etching of the steel by the iodine solution.

As ammonium nitrate solutions have been frequently used for the total stripping of cadmium coatings, their application to dropping methods was tried

by R. O. Hull and found to yield satisfactory results. The method was confirmed by P. W. C. Strausser, who also applied it to zinc coatings.

It was found that the rate of dropping of acidified ammonium nitrate solutions does not have much effect upon the results, especially if a fairly rapid rate, such as 80 to 120 drops per minute, is used. The results are therefore expressed in terms of the time instead of the number of drops required to dissolve a given thickness of coating. For convenience the concentration of each reagent was adjusted empirically by tests with coatings of known thickness, so that each 0.00001 inch of coating requires 1 second. No accurate control of temperature is required. A change from 25 to 35°C (77 to 95° F) increased the rate (that is reduced the time) about 10 per cent.

The dropping methods are especially convenient for testing any part of a large article, the complete stripping of which would be impracticable. On small articles these methods consume less reagents than would be needed for complete stripping by immersion.

The latter method may be used, with the same reagents, to determine the approximate distribution of the coatings on small articles. If the latter are moved rapidly in the solution, the initial time required for exposing the base metal corresponds roughly with that required for the same thickness by the dropping method, but the results are not so consistent.

Method of Operation

The apparatus, can be readily made from the usual laboratory equipment. A 250-ml separatory funnel is connected by rubber tubing to a straight two-way stopcock, the lower end of which is drawn down to a tip with an orifice similar to that on the average burette. A glass or porcelain dish is placed under the tip, and the specimen is so supported that the drops of liquid strike the point to be tested and run off quickly without touching areas to be subsequently tested. A longer rubber tube than that shown is an advantage when testing articles of irregular shape, as then the drops can be directed. If feasible, the surface tested should be inclined at least 45° from horizontal.

The surface of the specimen should be cleaned so that it is free from "waterbreak," for example by treatment with an organic solvent, followed by light rubbing with a magnesium oxide suspension. The surface should be dry at the beginning of the test.

Before a test, the stopcock of the separatory funnel is opened wide and the solution is allowed to fill the lower tube. The lower cock is then adjusted so that 100 ± 20 drops fall per minute. The upper cock is

*From The Monthly Review of the American Electro Platers' Society, March, 1935.

¹J. Electrodepositors' Tech. Soc. 8, No. 11, May, 1933.

closed, the specimen put in place, and the upper cock again opened. The period required from the time the first drop touches the plate until bare steel is exposed is measured with a stopwatch. The upper cock is then closed. If the articles are to be replated, they should be quickly rinsed, especially after testing zinc coatings with the more acid solution.

Recommended Conditions

1. For Cadmium Coatings—After numerous preliminary experiments, a solution containing 110 g/l of C. P. ammonium nitrate and 10 ml/l of concentrated hydrochloric acid (sp. gr. 1.18, containing 36 per cent of HCl) was selected for cadmium coatings. Typical results with it are shown in

Table 1. Dropping Tests on Cadmium Deposits. Solution containing 110 g/l of NH_4NO_3 and 10 ml/l of conc. HCl.

Dropping rate = 80 to 120 drops/min. Room temperature.

Expt. No.	Addition to Depositing Solution	Average Thickness From weight In.	Average Time Seconds	Error Percent ²
1	sulphite waste	0.00024	24	0
2	sulphite waste	.00047	51	+ 9
3	sulphite waste	.00044	51	+16
4	none	.00051	43	-16
5	none	.00049	43	-12
6	Ni + sulphite waste	.00045	47	+ 4
7	sulphite waste	.00094	108	+15
8	sulphite waste	.00101	106	+ 5
Av.				+ 3

Part of the specimens used in these tests (and also those with zinc coatings) were selected from the weighed specimens produced in the preparation of samples for the exposure tests, and part were prepared in small jars, with precautions to obtain uniform distribution of the coatings. The average thickness of each coating was computed from the weight of the deposit. In some cases these values were confirmed by completely stripping the specimens after the dropping tests were completed, and reweighing the base metal.

Each period reported in Table 1 is the average of nine tests on each side of the specimens. The errors have been computed on the basis of one second for each 0.00001 inch of deposit. The data show that the average results for the three types of cadmium deposit are close to the true values. Bright deposits, produced in solutions containing organic addition agents, require somewhat longer to dissolve than the dull deposits from plain solutions. Most commercial cadmium plating is produced from solutions containing brighteners. The use of the above solution and factor therefore allows a tolerance of approximately 10 per cent in the testing of bright deposits, which is about the limit of accuracy of the method.

2. For Zinc Coatings—It was found that plain zinc deposits were dissolved approximately at the rate of one second for 0.00001 inch by a solution containing 100 g/l of ammonium nitrate and 55 ml/l of concentrated hydrochloric acid. If, however, the zinc was deposited from cyanide solutions containing a small amount of mercury, the results with the hydrochloric acid solution were indefinite and inconsistent.

It was then found that by substituting nitric acid for hydrochloric acid, the solution dissolves all types of plated zinc coatings (but not hot-dipped coatings)

²Calculated on the basis of one second for each one-hundred thousandth inch.

at about the same rate, although the endpoint is somewhat less distinct with deposits containing mercury. The solution finally adopted contains 100 g/l of ammonium nitrate and 55 ml/l of concentrated nitric acid (sp. gr. 1.42, containing 70% of HNO_3). Typical results with this solution are shown in Table 2. These results show that the method is applicable with an accuracy of about + 10 per cent to zinc deposits from both acid and cyanide solutions, including those containing mercury.

Table 2. Dropping Tests on Zinc Deposits. Solution containing 100 g/l of NH_4NO_3 and 55 ml/l of conc. HNO_3 .

Dropping rate = 80 to 120 drops/min. Room temperature.

No.	Depositing Solution	Average Thickness From weight In.	Time Seconds Average	Error Percent ²
1	cyanide	0.00026	26	0
2	cyanide	.00047	42	-11
3	cyanide	.00097	101	+ 4
4	cyanide + Hg	.00047	43	- 9
5	sulphate + dextrin	.00051	53	+ 4
Av.				- 2

Conclusions

With appropriately selected solutions that have been standardized against deposits of known thickness, dropping methods may be used to determine the local thickness of zinc and cadmium deposits. These methods will probably prove useful for measuring the minimum thickness and the distribution of the deposits, especially on large articles.

²Calculated on the basis of one second for each one-hundred thousandth inch.

Sealing Leaky Welds

Q.—We desire a liquid chemical or a metallic powder to pour into radiators or boilers for stopping leaks. We cannot use a cement paste to be put on the outside. We certainly will appreciate this information, as every time we prepare a cast iron boiler with the electric arc, small pin holes develop, and we want a chemical that will seal these holes.

A.—Numerous materials have been tried to stop small leaks through the joints and porous sections of cast-iron boilers. The oldest prescription made use of a sack of wheat bran, or a quantity of manure where the boilers were located at a coal mine operated by mules. The modern idea is about the same, but more refined and highbrow. The use of a quart or half-gallon of sodium silicate, or water glass, will produce the starch or "goo", especially if a little hydrochloric acid is added. This product, or colloid as it is called, will enter the pores in the casting or joints and eventually will more or less clog them up. Rusting will promote the clogging.

There are a number of ready-to-use commercial concoctions on the market for stopping minor joint leaks. Copper oxide, such as used for the plates in Edison wet batteries, when pulverized and thinned with water or water glass might possibly be forced by steam pressure into the pores of leaky castings. Then if such spots were heated to redness by a torch applied to the outside, the pin holes would be sealed by copper welding. Where the spots can be cleaned out or notched from the outside, the copper paste applied and then thoroughly heated, the repair may be made very substantial. Cast-iron parts are welded or brazed readily by this method, using granulated brass for filling metal.—Mechanical Engineer.

Metal Products Manufacturing Company 100 Years Old

R. WALLACE & SONS Manufacturing Company of Wallingford is celebrating the 100th anniversary of the founding of the company by Robert Wallace. Bronze medals, showing the head of the founder, a replica of the original factory and a view of the present plant are being distributed to the trade.

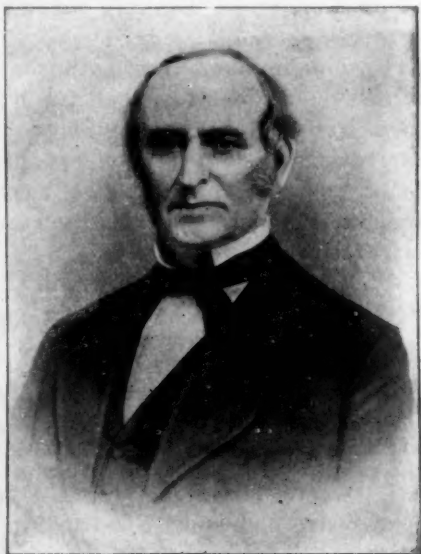
The company is also honoring a number of its veteran employees who have served 40 years and more, one of whom has served 68 years. The names and dates of their entering service are: Alfred Kahl, 1867; Martin P. O'Connor, 1868; Barnard F. Luby, 1877; Louis A. Page, 1877; Charles G. Myers, 1878;

solid silver. Mr. Wallace purchased a bar of German silver and had it rolled and became the first manufacturer of German, or now nickel, silver spoons in America.

In 1871 he began the manufacture of iron spoons



One Hundredth Anniversary Medallion



ROBERT WALLACE
Founder of the Company

H. A. Collett, 1880; Frank W. Talbot, 1883; John Kelley, 1880; Harry I. Clulee, 1881.

The concern was founded by Robert Wallace, son of a farmer in Prospect, Conn. He learned from Capt. William Mix of Mixville how to make Britannia spoons when 16 and soon after started his own factory, making spoons by water power in an old grist mill. He later learned that a new type of metal, harder than Pewter or Britannia, was being made into spoons, called German silver. Spoons were made of this in England and cost as much as a spoon of

and in 1875, that of forks and spoons of sterling silver, and in 1877 the manufacture of silver plated flatware. This, with a base of cast steel, were developed from the manufacture of iron spoons. A later development was plating the steel with tin for utensils used in hard service. Great advancements were made in the manufacture of sterling silverware from 1880 on, the company's flatware, hollow ware and dresser silver comparing favorably with the finest products in this country. Further expansion embraced hotel ware, plated hollow ware, trophies, wood handles, and Jaspote handle kitchen utensils, chromium plated flatware. The company furnished silver for the Leviathan and for six Japanese steamships. Its trophies have been awarded for every conceivable achievement; egg laying, baby parades, beauty contests, championship cups, including the trophies for the annual \$50,000 gold cup Hawthorn races at Chicago. It maintains five branches, New York, Philadelphia, Chicago, San Francisco and Los Angeles and has 35 sales representatives, who sell either directly to the retailer or through jobbers.

The company is now headed by a grandson of Robert Wallace, Charles D. Morris.

Few factories have an employee with the record of Mr. Kahl, in continuous service since 1867. He has been head of the alloy department and during his life has handled bullion valued at over \$52,000,000. Mr. O'Connell has been in the polishing and trimming departments most of his life and has seen the clipping die give way to the trimming wheel, and the automatic polishing machine replace hand work.

W. R. B.

Present and First Factory Buildings of
R. Wallace & Sons Manufacturing
Company



EDITORIALS

The Business Situation

A GLANCE at the table of Corporation Earnings on page 148 of this issue will show that 1934 was a considerably better year than 1933. Almost all of the companies in our industry which reported their earnings, showed improvement. So much for the past. We are grateful but we must turn our faces forward.

Manufacturing activity in January was 9% higher than in December, according to the monthly survey of the National Industrial Conference Board. Business conditions in February showed a slight improvement over January. The total of unemployed workers in February was 9,898,000 according to the regular monthly estimate of that Board, a decrease of 2.4% from the preceding month, but an increase of 0.2% over February, 1934.

January and February are notoriously slow months. The pick-up should begin in March. On the whole this pick-up has been lagging. Some branches, fortunate enough to obtain business from the automobile industry, are doing quite well, but by and large, progress has not been satisfactory.

It is too soon to say that the season has been lost. It is not too soon, however, for us to recognize that doubts and fears are delaying our recovery. Under the circumstances, prevailing business has done as well as can be expected. Automobiles are doing well and the retail trade is not bad. Other industries, however, would be considerably improved if they were assured of an improvement in the situation in Washington.

Whither Bound?

THE entire business public, and a growing part of the general public, are becoming sorely beset with doubts and fears. Business is set to go ahead if it could only tell where. This is not the first time in our history that business has been held back by fear of Government action, but it is probably one of the clearest examples of such a state of affairs.

Congress is in a jamb. Only one bill of importance—the appropriation for public works and relief—has been passed, and at the time of writing, fresh revisions making for delay are coming up. Business does not know which Washington intends to press

forward—reform or recovery. It is waiting for decisions in the Courts about the constitutionality of the N. R. A., and directly after that, what new legislation will be passed to replace the N. I. R. A. which expires on June 15th. International exchange is in a turmoil. New banking legislation is imminent, and a large number of other vital measures are being discussed in Congress. But no headway is being made.

There are some opinions from authoritative sources that this delay may result in the loss of the Spring season, which should be here by now. No one is willing to risk expenditures for expansion or lay plans for campaigns which involve heavy commitments without knowing that the track will be reasonably clear.

What will Congress do? When will it do it? On these questions hinge our hopes for a good year in 1935.

New Business in Better Housing

A BAND wagon is passing. It is a band wagon of great size and stout construction, and there is room on board for "many a more." This band wagon is the Better Housing Program of the Federal Housing Administration.

Very few developments in the past decade have had such possibilities for business for the metal and plating industries. The building industry was always a huge consumer but metals may have played a minor part in the construction of buildings; brick, concrete, wood and steel forming the bulk of the material. But this project—home modernization—is concentrated as never before on metals. Homes use comparatively little steel in their construction. Moreover, the work proposed is to a great extent, repairs and replacements. What parts are involved? Roofing, gutters, down spouts, flashing, porch enclosures, heating plants, hot water installations, plumbing, electrical equipment, kitchen improvements, cooking and mechanical refrigeration equipment, bathroom improvements, hardware, ventilation and air conditioning. These call for copper and brass piping and fittings, metal hot water tanks, plated and finished radiator enclosures, metal plated and finished door knobs, general hardware, copper coils for hot water, aluminum for washing machines, plated and

finished trim and hardware for refrigerators, plated and finished trim for kitchen stoves and ranges, non-ferrous metal for burners, metal plumbing fixtures, plated and finished; metal valves for water systems. Even the furnaces have now been dressed up with plated and specially finished trim. And now we have the latest development in metals, aluminum foil for weatherproofing.

Here is work for the brass foundry, the brass rolling mill, the machine shop and the plating shop. How to get it? For the manufacturer of these products, directly from the householder or from the contractor or through jobbers and retailers. For the job shops—from the manufacturer.

The Better Housing Program band wagon is big enough to hold millions and millions of dollars of work. Get on board!

Rolling Mill Developments

THE brass rolling mill is one of our oldest manufacturing institutions. Starting with Paul Revere, it has maintained the pioneer tradition of being in the forefront of invention. Nearly a generation ago, it opened its doors to technical control, the burette, the microscope and the pyrometer, and since then, the x-ray and the spectrograph. It was one of the first to adopt electric melting and bright annealing. Automatic machinery has always found a welcome.

Now we hear fresh rumblings and stirrings from depths. The sounds are not clear; we cannot distinguish each word, but the meaning is unmistakable. New processes are coming in.

First, there is direct rolling—pouring the molten metal into rolls and making strip directly, eliminating the casting shop, scalping and breaking down. Another process is improved tube reducing, eliminating pointing, eliminating intermediate anneals and making larger reductions per pass than ever before realized; all on the principle of using compression in processing instead of tension. And still another is continuous strip annealing, the strip fed in at one end of the furnace from the coil, emerging from the other end and coiled directly.

The sum of these three processes alone is a revolutionary change in brass manufacture. We are reliably informed that such changes are definitely on the way in.

Profits from Quality

EVEN as long as fifteen years ago, it was becoming evident that profits from standard lines were small. Year by year the margin became narrower and narrower. The pinch was slowed down by the

increased use of improved equipment, but profits finally disappeared in the plunge that began in 1929. To-day, even after some recovery, the standard lines are still very poor in earning power. Whatever real profits do exist are largely from specialties that have a distinct sales appeal.

Upon what does a sales appeal rest? Retail merchants have long known that ultimate consumers can be swung by improved quality or appearance, or by new products for new uses, opening up new markets. How can these principles be applied in materials or equipment sold to manufacturers?

The best answers to this question are the concrete examples of what has actually been done. Witness the following.

Aluminum and nickel have found a score of new openings for new alloys, special quality products with a better margin than the old standard alloys which any one can make.

New copper base alloys using silicon, nickel, aluminum and most recently beryllium, have found new uses and replaced old alloys; another quality product.

Zinc is pressing its Seal of Quality campaign—a two-ounce coat per square foot on hot dipped work; a quality product which increases the use of zinc.

These are only a few examples applicable to foundry, rolling mill and manufacturing operations.

Plating had its day in the sun when chromium burst upon the public. But chromium is now an old story. What is next?

The next is clearly above the horizon—specification plating—the plate of known thickness, of assured quality, of long life. Facts have been established through research; tentative specifications have been drawn up. Approval as they stand or in revised form, will follow shortly. Then will follow the education of manufacturers and then the education of the public.

A long job it is true, but immensely worth while. Plating will then offer a quality product for which a fair profit can be obtained.

The New York Sales Tax

WE HAVE had a large number of inquires from jobbing electroplaters within the city of New York, asking for advice on whether or not they are required to charge a sales tax for their work and to remit this tax to the city. We are in receipt of the following communication from the Department of Finance of the City of New York, which gives a complete answer to this question, reading as follows:

"Electroplaters are not required to add a tax on the charges made for electroplating and finishing metal products. Electroplaters purchasing supplies, such as buffing wheels, compositions, etc., are deemed to be the ultimate consumers thereof, and are required to pay the tax to their vendors thereon."

Correspondence and Discussion

Vapor Degreasing

To the Editor of *Metal Industry*:

We have read with great interest the sections on pages 5 and 6 of the 1935 Solutions Edition of Platers' Guide Book recently published by you devoted to "Vapor Degreasing" and "Metal Cleaning". Believing that readers of this Guide Book would be interested in more complete information concerning the application of solvent degreasing to the cleaning of metal prior to plating, we are taking the liberty of pointing out certain inaccuracies occurring in the above mentioned sections.

Actually vapor degreasing is merely one specific form of the more general cleaning method known as "Solvent Degreasing". This process utilizes the solvent capacity of certain chlorinated hydrocarbons for all types of oil and grease. The solvents may be used in the form of the liquid or their vapors or a combination of these two methods. In any case the grease, oil and dirt adhering to the surface of the work is removed by dissolving the oil or grease in the solvent. The process is therefore basically and fundamentally different from alkali cleaning since in the latter cleaning method the grease and oil are saponified or emulsified by the aqueous solutions used.

Our experience has been that prior to plating vapor degreasing is not entirely satisfactory in that most of the solids remain on the work after degreasing. However, by using a modification of this cleaning process in which the articles are first washed in the liquid solvent and then rinsed in the solvent vapors, these solids are removed due to the washing action of the liquid solvent.

It has been our experience that as stated in the second paragraph of the section on vapor degreasing, it is usually necessary to complete the cleaning by means of a short alkali treatment. However, the complete removal of oil and grease from the work prior to its introduction into the alkali cleaners prevents the formation of an oil film or scum on the surface of these cleaners. Thus the necessity of removing this scum is eliminated and contamination of the work with oil and grease upon being withdrawn from the alkali cleaner is prevented.

On page 6 in the third paragraph, you state "that organic solvents such as gasoline, benzene or Carbon Tetrachloride are found to give the best results in removing mineral oils. Gasoline and benzene, although still extensively used, are rapidly being displaced in industry by other solvents and particularly by solvent degreasing methods because of their inflammability. Carbon Tetrachloride is also being rapidly displaced because of its tendency to decompose in the presence of water to give hydrochloric acid, a highly corrosive material. We feel, therefore, that solvent degreasing processes using stable, non-flammable solvents such as Trichlorethylene or Perchlorethylene, should be added to this list of alternate methods of removing non-saponifiable oils.

We would be glad to cooperate with you in every possible way to supply you with the latest data concerning solvent degreasing methods or the materials used in this process.

E. I. Du PONT de NEMOURS & COMPANY
Wilmington, Del.

Thomas Coyle,
Manager, Chlorine Products Sales

I wish to say that constructive criticism such as yours is always appreciated. We do not consider any statement made in these articles to be inaccurate and if space had been available the subject would have been described in detail.

The vapor degreasing method of removing oils and grease was referred to because it is a comparatively recent development and those who are interested in this method of removing oils or grease, I feel sure will consult your company for full details of the process.

Under the subject Metal Cleaning, I can see no reason why

Trichlorethylene could not be included with the other solvents mentioned, to remove non-saponifiable oil or grease. I should be pleased to receive the latest data you have concerning solvent degreasing methods and the materials used in this process, for future reference.

Newark, N. J.

O. J. SIZELOVE

Imported Bronze Castings

To the Editor of *Metal Industry*:

I have read with great interest an article in one of the recent foundry trade papers, regarding the importation of bronze castings for statuary and other memorial purposes, such as are now installed and in service in our various churches and also in our public parks and on highways.

It is regrettable that only half of the story is told. Steps have been taken from time to time by various manufacturers of this class of material, to endeavor to eliminate this evil condition, for it can be classed under no other hand.

We had occasion recently to note an installation in one of our prominent churches, in the City, of a work of artistic bronze, where the facts show that more money was paid for the imported article than would have been the case if it had been obtained in the local market. The reason for having placed the order abroad was given that it would be impossible to obtain the work in this country due to lack of facilities and lack of competent mechanics. This excuse, on the surface, must appear ridiculous, as the men who are doing this kind of work in this country have learned their trade mostly abroad, having fully acquired all the technicalities concerning same and applying same to the best of advantage in this country, with possibly better and more modern facilities, thereby insuring a higher degree of work. Furthermore, there is no question but what the domestic manufacturer would take a greater pride in his work than might be shown by the foreign manufacturer, inasmuch as the latter would get his money before he started, and once having possession of the funds, he would be in a position to sell what he pleased. This condition would not prevail if the work was done in this country, where the manufacturer would have to finance the job until completed and then, possibly, wait for his money, as has been the case many a time.

If a careful examination were to be made of the various statutes which have been erected in our own local territory, surprising results might be found of this investigation. Even if such works as were imported in the last fifteen or twenty years were to be examined, the results might be astonishing.

It would certainly seem unfair, where the money for memorial purposes is solicited and gathered from our own citizens and our own population, that this money should be diverted abroad and all because of motives which are not sincere nor patriotic. It would seem that our National Foundry Organization should take drastic measures to obtain the passage of suitable laws, forbidding this kind of procedure.

In conclusion, it is also to be noted that general work of this kind is imported free of duty, coming under the head of unfinished work, or raw castings, and also as works of art and for religious and patriotic motives. Thus, the American Public gets trimmed on all sides.

Brooklyn, N. Y.

FREDERICK H. LANDOLT
Penn Brass & Bronze Works.

Government Publications

Tungsten. By William O. Vanderburg. U. S. Bureau of Mines, Washington, D. C. Information circular 6821.

Thermodynamic Data on Some Metallurgically Important Compounds of Lead and the Antimony-Group Metals and Their Applications. By Charles B. Maier. U. S. Bureau of Mines, Washington, D. C. Report of Investigations 3262.

Shop Problems

This Department Will Answer Questions Relating to Shop Practice.

ASSOCIATE EDITORS

Metallurgical, Foundry, Rolling Mill, Mechanical Electroplating, Polishing, and Metal Finishing

H. M. ST. JOHN
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W. J. PETTIS
W. B. FRANCIS

O. J. SIZELOVE
WALTER FRAINE

Bright Finish on Stainless Steel

Q.—In our burnishing experiments we occasionally have difficulty in securing a nice finish on stainless steel parts. What do you recommend as an acid dip or bright dip on parts such as this prior to their being placed in the burnishing barrel?

A.—We do not know of any bright dip that can be used on stainless steel to produce a bright finish.

Instead of using the steel burnishing balls, we would suggest that you use small carborundum chips and a soap solution for the burnishing operation.

Problem 5,373.

Etching Stainless Steel

Q.—I am having trouble getting a satisfactory etch on stainless steel. I am using muriatic of iron solution. If I go a little deeper than the sample, the resist comes off. Do you know of any other methods besides muriate of iron that will produce a deeper etch and that the resist will withstand?

A.—We believe that the chloride of iron solution is the

best of the different etching solutions for your class of work. The trouble you are having is due to an unclean surface of the work before the resist is applied which does not allow the resist to adhere properly.

Problem 5,374.

Heavy Brass Deposit

Q.—We are sending you under separate cover a 3 oz. sample of our brass plating solution. Also in the same package a sample of drillings from our brass anodes. We would ask that you analyze the anodes for their zinc content and also have the solution analyzed thoroughly.

To be more specific with the present working qualities of this solution we might say that the color we are getting from it at this time is very satisfactory but in order to get sufficiently heavy deposit enough for making antique finishes, such as antique brass and heavily scratch brushed finishes, it is necessary for us to plate our pieces as much as $3\frac{1}{2}$ to 4 hours. This of course you will recognize is entirely too long.

What we want is a brass solution that will deposit a heavy deposit in a short space of time of a good yellow brass color. The other information regarding working qualities of this

USE THIS BLANK FOR SOLUTION ANALYSIS INFORMATION

Fill in all items if possible.

Date.....

Name and address: Employed by:

Kind of solution: Volume used:

Tank length: width: Solution depth:

Anode surface, sq. ft.: Cathode surface, sq. ft.:

Distance between anode and cathode: Kind of anodes:

Class of work being plated: Original formula of solution:

REMARKS: Describe trouble completely. Give cleaning methods employed. Send small sample of work showing defect if possible.

Use separate sheet if necessary. _____

NOTE: Before taking sample of solution, bring it to proper operating level with water; stir thoroughly; take sample in 2 or 3 oz. clean bottle; label bottle with name of solution and name of sender. PACK IT PROPERLY and mail to METAL INDUSTRY, 116 John Street, New York City.

solution we are enclosing on a blank ticket from The Metal Industry.

A.—Analysis of brass solution:

Metallic copper	1.65 ozs.
Metallic zinc22 oz.
Free cyanide	1.43 ozs.

The different constituents of this solution are quite low for heavy deposit of brass. We would suggest that you add 2 ozs. of copper cyanide, 1 oz. of zinc cyanide, and 4 ozs. of sodium cyanide to each gallon of solution. Operate solution at 80° F.

Analysis of the drillings from the anodes is copper 80%, zinc 20%.
O. J. S., Problem 5,375.

Plating and Finishing Metal Ware

Q.—We use different solutions such as silver, cyanide copper, brass and gilding and would appreciate any helpful information you could give me along these lines.

It is necessary to copper plate some of our copper before silverplating it as the grain in the copper shows up when silverplating. We are using a cyanide copper solution and I would like to know if an acid copper solution would be better for this purpose.

What is the best process for stripping silver off copper? I find that the sulphuric acid strip attacks the copper.

I would like to know how to put an Old English reproduction finish on silver. We have been oxidizing with ammonium sulphide then rinsing it off in a cyanide dip and then rouge-buffing it. We have been applying the sulphide with a paint brush and then heating it with a torch and this is a slow process. Could you tell me a better and also faster way and also the different chemicals used for preparing different sulphides?

A.—If the base metal which you are plating has stock defects, the proper way to eliminate these defects would be by a polishing operation and not a plating operation.

Any strip solution that is used for removing silver from a copper base will attack the copper somewhat. The acid strip generally used is made of nitric acid 1 part and sulfuric acid 5 parts and used hot. All water must be kept from the trip to prevent it from roughening the base metal.

Liquid sulfur mixed with water and a small amount of 26° ammonia is generally used for oxidizing silver before relieving for oxidized silver finishes. If used in the proportion of 1 oz. of liquid sulfur, ½ pint of ammonia to a gallon of water, and used at boiling temperature, the work can be dipped in the solution to produce a black finish, after which it can be relieved.

If you desire to paint the work, then use twice the amount of liquid sulfur and the ammonia to a gallon of water, and after painting the work, place on a hot plate to dry. The heat on the hot plate should not exceed 250° to 300° F.

Problem 5,376.

Polishing Screw Machine Parts

Q.—We have a large order for staffs, and would like to know how the polished finish is produced. The pieces are made by automatic machine, hardened and left hard, then the finish is produced. Enclosed are sample which we wish to duplicate.

A.—The method used to produce the finish on the samples submitted is as follows:

The pins are placed in heavy duck cloth container with a fine grade of powdered red rouge and rolled between two wood planks for 12 to 15 hours.

The lower plank is stationary and the top one fastened to a cam arrangement so that the plank moves forward and backward, the distance of the movement being 16 to 18 inches. Proper loading of the work and the rouge is necessary, the amount of rouge being about ¼ of the weight of the work.

For a very high finish two grades of rouge are used; first a coarse grade and then a very fine grade which is followed by using fine powdered chalk.

Problem 5,377.

Stained Barrel Nickel

Q.—We are sending by parcel post a sample each of our copper cyanide and nickel solutions. Please analyze for all the important constituents.

The copper solution seems to be working satisfactorily; at least the work looks very good.

We are far from satisfied with the results of the nickel plating. The plate does not seem to be white enough. The pins appear to be stained; some more than others. How can we avoid this? We have the best nickel anodes.

Sometimes we find on them a yellowish, slimy substance and occasionally, underneath this slime is a fine black muddy substance. Whether we run the barrel one or two hours the stain is just the same. The load is 100 pounds; 8 volts, 40 to 50 amperes. How much time do you think would be required to run the barrel for a proper thickness on these pins?

A.—Analysis of nickel solution:

Metallic nickel	2.38 ozs.
Chlorides	1.92 ozs.
pH	6.0

Both the metal and chloride contents would be considered too low for barrel plating. We would suggest that you add to each gallon of solution 8 ozs. of single nickel salts, 2 ozs. of sodium chloride, and 2 ozs. of boric acid. The samples submitted have a very thin deposit of nickel and some of the staining may be due to this.

After the work is removed from the plating barrel, it should be rinsed thoroughly with clean cold water, then with hot water, and dried by tumbling with hardwood sawdust.

Analysis of cyanide copper solution:

Metallic copper	7.28 ozs.
Free cyanide	3.58 ozs.

Take one-half of the solution from the tank and then replenish with water.

Problem 5,378.

Stripping Silver

Q.—Please tell me how to strip silver.

A.—For a silver strip we would suggest that you use 5 parts of sulphuric acid and 1 part of nitric acid. The strip should be kept in a stoneware crock which is surrounded by hot water to heat the strip, as it works very slowly when cold. All water must be kept from the strip. The base metal if of copper, brass, or nickel silver, is but very little attacked. Nickel can also be removed in this strip, but would suggest that you use sulfuric acid diluted with water to 45° Be. and use lead cathodes with 6 volts.

In installing an electric cleaning solution, make the connection the same as for plating as the direct current is generally used.

Problem 5,379.

Weak Nickel Solution

Q.—I am sending you a sample of my nickel solution, it gives me a very light deposit, peeling off in fine flakes with black streaks running from the edge inward. The rest of the deposit may be good but it peels when chromium plated.

A.—Analysis of nickel solution:

Metallic nickel	1.36 ozs.
Chlorides	1.14 ozs.
pH	5.8

This solution is in a very poor condition and would suggest that you add to the solution 150 lbs. of single nickel salts, 20 lbs. of sodium chloride, 25 lbs. of boric acid, and 6 fluid ozs. of 26° ammonia.

Problem 5,380.

Patents

A Review of Current United States Patents of Interest

Printed copies of patents can be obtained for 10 cents each from the Commissioner of Patents, Washington, D. C.

1,972,769. September 4, 1934. **Broaching Machine.** William J. Fiegel, Winfield S. Enderich, and Leo Bracciano, Detroit Mich., assignors to Bohn Aluminum & Brass Corporation, Detroit, Mich.

1,972,787. September 4, 1934. **Machine and Process for Annealing Tubes.** Arthur J. Mason, West Hartford, and William L. Tancred, Hartford, Conn., assignors to The Bush Manufacturing Company, Hartford, Conn.

1,972,835. September 4, 1934. **Coating Ferrous Articles With Zinc.** Urlyn Clifton, Tainton, Baltimore, Md.

1,972,868. September 11, 1934. **Furnace Oscillating Apparatus.** Arthur F. Case, Cleveland, Ohio, assignor, by mesne assignments, to Scovill Manufacturing Company, Waterbury, Conn.

1,972,905. September 11, 1934. **Coating Composition and Method of Making the Same.** Israel Rosenblum, Jackson Heights, N. Y.

1,972,945. September 11, 1934. **Apparatus for and Process of Casting Metals.** Lars G. Nilson, Hoboken, N. J.

1,973,004. September 11, 1934. **Manufacture of Galvanized Steel Sheets.** Cyril Froude Langworthy and Helen Hughes, Richmond, England.

1,973,040. September 11, 1934. **Treatment of Aluminum.** Robert Beyer, Brooklyn, N. Y., assignor to Beyer Research Laboratories, Inc., Dover, Del.

1,973,087. September 11, 1934. **Metal Treating Compound and Method of Using the Same.** John W. Markley and Thomas W. Clement, Washington, Pa., assignors to Peerless, Incorporated, a corporation of Pennsylvania.

1,973,300. September 11, 1934. **Purifying Zinc Sulphate Solutions.** Joseph Camillus Thompson, Jr., Palmerton, Pa., assignor to The New Jersey Zinc Company, New York, N. Y.

1,973,302. September 11, 1934. **Alloy.** Robert J. Wiseman, Passaic, and Benjamin B. Reinitz, Paterson, N. J., assignors to The Okonite-Callender Cable Company, Incorporated, Paterson, N. J.

1,973,345. September 11, 1934. **Anode.** Alexander Henderson, Detroit, Mich., assignor to The American Brass Company, Waterbury, Conn.

1,973,422. September 11, 1934. **Hard Metal Composition.** Elmer B. Welch, McKeesport, Pa., assignor to Firth-Sterling Steel Company, McKeesport, Pa.

1,973,426. September 11, 1934. **Apparatus for the Degreasing of Materials by Means of Volatile Solvents.** William Edward Booth and Joseph Savage, Runcorn, England, assignors to Imperial Chemical Industries Limited, a corporation of Great Britain.

1,973,431. September 11, 1934. **Method and Apparatus for Coating Metal Strip.** Edward L. Davenport, New Castle, Pa.

assignor to Johnson Bronze Company, New Castle, Pa.

1,973,441. September 11, 1934. **Hard Alloys.** Kurt Moers, Berlin-Charlottenburg, Karl Schroeter, Berlin-Lichtenberg, and Hans Wolff, Berlin, Germany, assignors to Fried. Krupp Aktiengesellschaft, Essen-on-the-Ruhr, Germany.

1,973,488. September 11, 1934. **Lacquer.** Neil S. Kocher, Rochester, N. Y., assignor to Eastman Kodak Company, Rochester, N. Y.

1,973,550. September 11, 1934. **Mold.** Harold N. Todt, Detroit, Mich., assignor to Revere Copper and Brass, Incorporated, a corporation of Maryland.

1,973,612. September 11, 1934. **Method of Securing Durable Adhesions of Liquid Coatings to Zinc Surfaces.** Milford H. Corbin, Chicago, Ill., assignor to Ault & Wiborg Corporation, a corporation of Ohio.

1,974,011. September 18, 1934. **Process for Mechanically Corroding Relief Intaglio Variegated Surfaces on Metal.** John J. Burgess, Rock Island, Ill., assignor to Rock Island Register Company, Rock Island, Ill.

1,974,060. September 18, 1934. **Alloy and Article Composed of Same.** Hugh S. Cooper, Cleveland, Ohio, assignor to Kemet Laboratories Company, Inc., a corporation of New York.

1,974,140. September 18, 1934. **Production of an Adherent Patina Upon Copper or Its Alloys.** Clarence E. Irion and George L. Craig, Columbus, Ohio, assignors to The Battelle Memorial Institute, Columbus, Ohio.

1,974,144. September 18, 1934. **Casting Machine.** Ray O. Watkins, Chicago, Ill., assignor to Universal Battery Company, Chicago, Ill.

1,974,173. September 18, 1934. **Porous Metal Bearing Composition.** William G. Calkins, Detroit, Mich., assignor to Chrysler Corporation, Detroit, Mich.

1,974,436. September 25, 1934. **Flux for Use in Soldering.** William K. Schweitzer, East Cleveland, Ohio, assignor to The Grasselli Chemical Company, Cleveland, Ohio.

1,974,441. September 25, 1934. **Process and Apparatus for Electroplating.** Bjorn Andersen, Newark, N. J., assignor to Celluloid Corporation, a corporation of New Jersey.

1,974,480. September 25, 1934. **Manufacture of Bright Finish Tinned Material.** Thomas D. Williams, Garfield Heights, and Harley C. Ralston, Cleveland, Ohio, assignors to The American Steel and Wire Company of New Jersey.

1,974,570. September 25, 1934. **Pickling Solution.** George C. Kiefer, Springdale, Pa., assignor to Allegheny Steel Company, Brackenridge, Pa.

1,974,571. September 25, 1934. **Descaling Process.** George C. Kiefer, Springdale, Pa., assignor to Allegheny

Steel Company, a corporation of Pennsylvania.

1,974,610. September 25, 1934. **Galvanizing Pot Construction.** Percy Gray, Jefferson, Iowa.

1,974,744. September 25, 1934. **Finish Remover Composition.** Gustave Klinckenstein, Newark, N. J.

1,974,763. September 25, 1934. **Process for the Production of Roll-Gold Stamping Foils Upon Plates or Bands.** Karl Wirth, Berlin-Charlottenburg, Germany, assignor to Julius A. C. Fichtmueller, Stapleton, Staten Island, N. Y.

1,974,771. September 25, 1934. **Burnishing or Polishing Device.** Jose Figueras Fabregat, Barcelona, Spain.

1,974,822. September 25, 1934. **Die-Casting Machine.** Frank Lannert, Chicago, Ill., assignor to Paragon Die Casting Company, Chicago, Ill.

1,974,839. September 25, 1934. **Alloy.** Horace F. Silliman, Waterbury, Conn., assignor to The American Brass Company, Waterbury, Conn.

1,974,883. September 25, 1934. **Manufacture of Gold Leaf Carrier.** Donald D. Swift, Hartford, Conn., assignor to M. Swift & Sons, Incorporated, Hartford, Conn.

1,974,965. September 25, 1934. **Process for Cleaning Metal.** Raymond P. Matern, Elkhart, Ind., assignor to Minneapolis-Honeywell Regulator Company, Minneapolis, Minn.

1,974,969. September 25, 1934. **Alloy.** Joseph A. Nock, Jr., Tarentum, Pa., assignor to Aluminum Company of America, Pittsburgh, Pa.

1,974,970. September 25, 1934. **Alloy.** Joseph A. Nock, Jr., Tarentum, Pa., assignor to Aluminum Company of America, Pittsburgh, Pa.

1,974,971. September 25, 1934. **Method of Treating Alloys.** Aladar Pacz, Cleveland, Ohio, assignor to Aluminum Company of America, Pittsburgh, Pa.

1,975,053. September 25, 1934. **Method of Balancing Abrasive Wheels and Wheels Thereby Balanced.** Herbert R. Simonds, Dayton, Ohio, assignor to Simonds Worden White Company, Dayton, Ohio.

1,975,084. October 2, 1934. **Composition of Matter and Process of Treating Molten Metals.** Alfred H. Davies, deceased, late of New York, N. Y., by Edith Vail Davies, executrix, New York, N. Y.

1,975,105. October 2, 1934. **Duplex Metal Article.** Fred Keller and George F. Sager, New Kensington, Pa., assignors to Aluminum Company of America, Pittsburgh, Pa.

1,975,112. October 2, 1934. **Beryllium Alloy.** Georg Masing, Berlin, and Otto Dahl, Berlin-Charlottenburg, Germany, assignors, by mesne assignments, to Metal & Thermit Corporation, New York, N. Y.

Equipment

New and Useful Devices, Metals, Machinery and Supplies

Cadmium-Nickel as a Bearing Alloy

By CARL E. SWARTZ

Research Department, American Smelting & Refining Company,
Maurer, N. J.

Recently the trend in the automotive industry has been toward a higher compression, higher speed motor. The tendency in use has been toward a higher road speed, with a longer time elapsing between stops. The multi-cylinder motor of the straight line type, where a motor of four or six cylinders used to be, has forced the designer to increase the compactness as much as possible. All these conditions have had their effect on the bearings bringing heavier unit pressures, higher operating temperatures, longer periods of operation and sometimes undersized bearings in addition. As a result bearing failures have become more and more common and automotive manufacturers more and more dissatisfied with the conventional babbitts.

Use

A number of new bearing materials have been suggested recently. Some have been put into commercial use with considerable success. Among these latter are the alloys of the cadmium-nickel system, whose bearing properties were discovered in the Research Laboratories of the American Smelting & Refining Company. Alloys of cadmium containing approximately 1.3% Nickel are now being marketed by this concern under the tradename of "Asarcology No. 7."

The alloy was announced in June, 1933, at the Chicago meeting of the American Society for Testing Materials by a rather comprehensive paper (1) discussing and comparing the mechanical and bearing properties of cadmium-nickel alloys with those of a conventional babbitt. Results of a preliminary motor test were also described at that time. A little later data on the constitution of the cadmium-nickel system was presented (2) showing it to depart somewhat from the generally accepted equilibrium diagram of that system.

Since these preliminary announcements the alloy has created much interest among bearing manufacturers and automotive builders. In cooperation with one of the bearing manufacturers, it was shown that Asarcology No. 7 could be made into bearings on a commercial scale with the same equipment as is used for babbitted bearings. The higher melting point of the Asarcology No. 7 re-

quires a somewhat higher casting temperature however.

Sample bearings lined with Asarcology No. 7 have since been submitted to a large number of the automotive manufacturers for laboratory and road tests. The results of these tests have been very gratifying. Two motor builders adopted the alloy as regular equipment. Others have put the alloy in motors where severe service was expected. Aeroplane and diesel motor builders are also running extensive tests. In these fields Asarcology No. 7 has already been used to a limited extent.

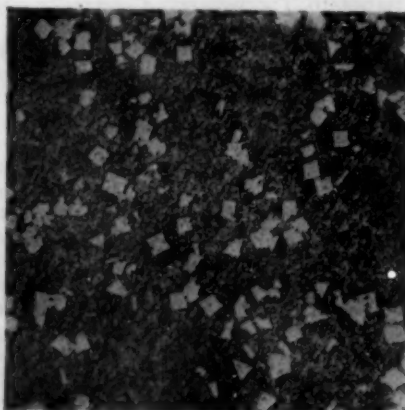
Experiments are in progress with the object of using the alloy for roll neck bearings, turbine thrust bearings and other industrial uses. The alloy has already proven its superiority in the impact pulverizer, the blower and similar installations.

Conclusion

From the data in the reports quoted above, the following conclusions are drawn:

Asarcology No. 7 is superior in many respects to the conventional white metal bearing alloys.

1. The compression strength or load carrying capacity is much greater at all temperatures.
2. The ductility is a little better than that of the ductile babbitts.
3. The hardness is greater at all temperatures. However, no constituent of Asarcology No. 7 is hard enough to



Asarcology No. 7. (1.3% Ni) x 100

Latest Products

Each month the new products or services announced by companies in the metal and finishing equipment, supply and allied lines will be given brief mention here. More extended notices may appear later on any or all of these. In the meantime, complete data can be obtained from the companies mentioned.

New 50 Amp. Vertical Welder with Stable, High Speed Arc. The Buchen Company, 400 W. Madison Street, Chicago, Ill.

New Laminated Contact Button. Made of fine silver, backed up with steel for electrical contacts in a wide variety of applications. General Plate Company, 32A Forest Street, Attleboro, Mass.

Special Condenser Drum Grinding Machine; for mechanical household refrigerators. Diamond Machine Company, 9 Coddling Street, Providence, R. I.

New 2-Quart Vaporizing Liquid Fire Extinguisher; discharged by air pressure and delivering a fan-shaped spray as well as a solid stream. Pyrene Manufacturing Company, Newark, N. J.

A New X-Ray Shield of Bakelite Laminated. Used for industrial x-ray equipment. Bakelite Corporation, Bound Brook, N. J.

Electrical Resistance Furnace; to operate up to 2300° F. through the use of a new metallic resistor element. Hevi Duty Electric Company, Milwaukee, Wis.

New Way of Mounting Metal Molded for Microscopic Analysis. Bakelite Corporation, Bound Brook, N. J.

scratch the softest steel shaft. The oxides are also soft so that in case of oxidation either in manufacture or operation no shaft wear will occur.

4. The coefficient of friction is lower than the tin babbitts.

5. Asarcology No. 7 will bond directly with copper or steel forming a strong ductile bond very similar to a weld.

6. The microstructure is similar to that of babbitt. The hard constituent is NiCd, cubes and the matrix is a soft plastic eutectic of cadmium and NiCd.

7. The melting point is 604°F. or about 130° above that of babbitts.

References

- (1) Swartz and Phillips: A comparison of Certain White Metal Bearing Alloys. Proc. Am. Soc. Test. Mat. Vol. 33, Part II, 416 (1933).
- (2) Swartz and Phillips: Notes on the Cadmium-Nickel System, Trans. A. I.M.E. Vol. 111, 333 (1934)

The Ballard Process of Copper Plating Printing Rollers

By RUSS B. LEACH

President, Standard Process Company, Chicago, Ill.

The Ballard Process, controlled by the Standard Process Corporation, 734 Mather Street, Chicago, Ill., of the plating intaglio printing cylinders was invented by Ernest S. Ballard, and was perfected sufficiently to warrant applications for Letters Patent in 1927. Since then various patents on the Process and equipment for its operation have been issued and other patents are still pending.

The old and only method known and used of treating copper-covered rotogravure cylinders for intaglio printing was as follows:

The cast iron or steel base of the cylinder was heavily plated with copper, sometimes as much as $\frac{1}{4}$ " in thickness. This surface, when ground and polished, was then the proper size for the work in hand. For instance, if they were cylinders for the printing of newspaper supplements, the standard would be 43" in circumference with approximately 72" face. The cylinder would then be etched and printed. Then the etching would be turned or ground off and the cylinder repolished, making the circumference or diameter slightly less than the original and proper size. After these

polished cylinder before plating the final Ballard shell, is .012" less in diameter than the printing size of the cylinder. This means that the Ballard shell is .006" in thickness, and this thickness of shell has been adopted by all the rotogravure printers in this country.

The surface referred to as the base copper is very smoothly polished, because any imperfections on its face would naturally show on the surface of the very thinly plated Ballard shell. The surface of this highly polished base copper is swabbed with a nickel salts solution, which provides it with a chemical plating of nickel. This can be done in a few minutes and at practically no cost, and gives the same final surface as though there were a thick electrolytically plated nickel surface. This nickel surface is then rubbed over with a very thin oil. Then, with a piece of chamois or cheesecloth, the cylinder is rubbed vigorously until there is apparently no trace of the oil left on the surface. No matter how much one rubs, however, there is always a sufficient film of oil left to do its work. This, together with the nickel surface, allows of the easy removing of the

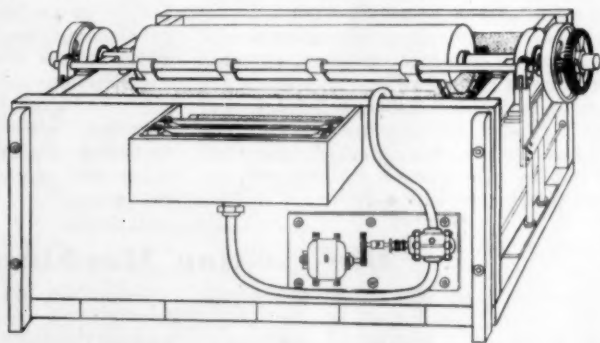
little copper plated, and it is plated so thinly and with such fine texture, the surface of the cylinder, when removed from the plating bath, is as smooth to the eye or to the feel of the hand, as the base copper on which it was plated. A magnifying glass, however, will show a very fine grain on the surface, and while it oft-times would not show in the print, it is subjected to a very short polishing with 000 paper, or preferably finishing stones, which are used with water, and the cylinder is then ready for etching.

After etching and printing, and the cylinder has been returned to the Plating Department, the shell is removed in 2 or 3 minutes as follows:

A knife or any sharp instrument is used at the end of the cylinder where the shell has feathered off, say a couple of inches below the face of the cylinder, to loosen and tear up to the end of the cylinder a couple of ribbons of thin copper. These are then pulled alternately straight across the face of the copper and over the other end of the cylinder, which completely removes from the face of the cylinder a width of an inch or so of the shell. This allows the air to get under the edges of the shell, and the operator simply with his hands strips the entire remaining sheet of thin copper shell from the cylinder. It is then necessary merely to clean up the ends of the cylinder, after which the oiling operation only is repeated, and the cylinder is immediately ready for another plating.

The principal points of advantage being as follows:

1. Keeping of a constant and uniform diameter of the cylinders. This is absolutely necessary in color process work, which is so much in demand.
2. A considerably smaller investment is necessary in printing cylinders, which are costly. Before the Ballard Process was adopted, the larger rotogravure printers of necessity had a great many of their cylinders in the plating baths at all times.



Ballard Process of Plating

cylinders were etched, printed, ground and polished several times, they would be too small for further use. Probably as much or more than $\frac{1}{8}$ " on the side would be used in these various grindings, which in the meantime would necessitate many hours of work in changing the folder before printing. This was necessary not only because one certain set of cylinders was considerable below size, but because no two sets of cylinders in any plant would be of the same circumference.

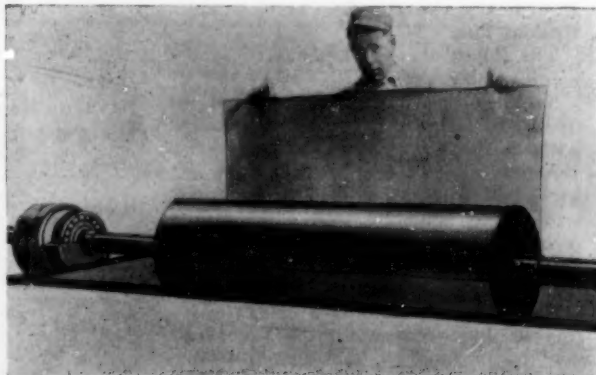
After they had taken as much copper off as they dared, and the cylinder with its smaller diameter was no longer usable, they would then put them in their plating tanks and take a couple of weeks to plate the necessary thickness of copper to get them back to size.

The Ballard Process does away with all of this. The printing cylinders, when baseplated, ground and polished to size, remain so forever unless some accident befalls them. This ground and

plated Ballard shell by means of stripping.

With the oiling operation over, the cylinder is introduced into the plating tank, which is equipped with a patented anode cradle arrangement, etc. and the Ballard shell is plated thereon in slightly more than an hour. There being so

Stripping the Shell



3. Eliminates baseplating, and constant grinding of cylinders is no longer necessary. The cylinder remains constant in size at all times, the only plating that is necessary being the thin Ballard shell, which takes a little more than an hour to put on.
4. The cost of operation of this department is from 30% to 50% cheaper than by the old method.
5. Absolute uniformity of copper texture makes etching easier and more positive.
6. A simple, positive and fool-proof plating operation, no previous plating experience being necessary on the part of the operator.

Non-Crystalline Copper

According to an announcement from H. M. Rice, metallurgist and manager of the Nichols Copper Company, 230 N. Michigan Ave., Chicago, Ill., a unit of the Phelps Dodge corporation, a new chemical process has been discovered for reducing copper to a non-crystalline form, suitable for use in a liquid vehicle and giving in effect, the equivalent of liquid copper.

The metal, 98.3% pure, can now be applied in this liquid form Mr. Rice reports, to give a virtual sheath or armor of copper upon almost any surface. The new product is not to be confused with the common copper oxides of bronze powders, he points out.

By virtue of the shapeless form of the tiny copper particles which are so small that they penetrate a 350-mesh screen, no minute gaps are left in the coating after application by spraying, dipping, or by a brush. The copper remains in suspension in the special vehicle that has been developed, assuming an approach to a semi-colloidal state, it is reported. Laboratory and field tests are said to indicate that the product should have a useful life of five to ten years or longer. It is also highly resistant to acid and other corrosion.

New Aluminum Solder

A new type of solder for aluminum and its light alloys has been developed by the Aluminumix Solder Company, 50 Cliff Street, New York. This solder, it is said, will stand all practical tests against fracture of joints or deterioration of the solder. Joints, cracks and breaks can be soldered or welded using an ordinary soldering iron or blow torch without flux.

The following tests are quoted by the manufacturers.

Samples have been submerged in fresh and salt water for several months without the least deterioration.

A butt joint of $1 \times \frac{1}{4}$ " aluminum bar has stood a stress of over 1700 pounds after being soldered with Aluminumix. A No. 10 round aluminum wire with a butt joint soldered stood a pull until the wire was distorted.

A $\frac{3}{4} \times \frac{3}{8}$ " aluminum bar with a soldered butt joint was put in a vise and bent to an angle of 60° ; the joint held.

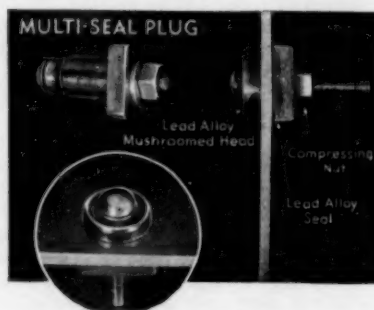
Quick Repair Rivet and Seal

The Multi-Seal Manufacturing Company, 7755 Sheridan Road, Chicago, Ill., has developed an unusually interesting device for repairing large or small holes, cracks, leaky rivets or seams in hot

water tanks, range boilers, pipe lines, chemical tanks, air compressors and other types of containers. It consists of a special rivet which can be used to secure patches over large holes and also to fasten sheet metal pieces together. The outstanding feature of this rivet is that it can be applied from one side of the job.

The rivet forms three seals which, it is stated, will withstand 2,000 pounds pressure. It is made of a strong, ductile composition metal which expands as a hex nut is drawn down and a ferrule on the tip of a plug fans out, compressing a metal head on the inside of the container.

This device can be used to replace leaky rivets and also to anchor cabinets, machinery and other equipment into stone, cement, brick, etc.



Multi-Seal Plug

Line of Grinders and Buffers

Skilsaw, Inc., of 3310 Elston Avenue, Chicago, announce an important addition to their line of portable electric tools—a new and very complete line of bench and pedestal grinders and combination grinder-buffers both bench and pedestal type. The wide selection of sizes available includes units for intermittent tool shop use and for production grinding and buffing.

Skilsaw grinders, it is claimed, have decidedly new mechanical and construction features. The totally enclosed motors are extra powerful; dynamically balanced to eliminate vibration; mounted on highest grade ball bearings which are sealed and grease lubricated for longer life. Frames are of heavy metal, very strong and durable, finished in attractive blue-gray lacquer. Motors in the bench grinders range from 1/6 H. P.,

split phase type or condenser type in the 6 inch size, to $1\frac{1}{2}$ H. P., 220 volt, 3 phase type in the 10 inch size.

Motor design, construction characteristics and performance of the line of combination grinder-buffers are identical to Skilsaw Bench Grinders, excepting that motors in these units are all condenser type. This motor can be slowed down in speed and stalled any number of times without damage to motor. Workmen inclined to bear down on wire brush or buffing wheel, presumably overloading the motor to its stalling point, cannot damage this unit.

Equipment on the grinders is complete, including guards, tool rest, cords, switches, wheels, etc. Units can be furnished in all popular voltages for the types and sizes of grinders which are available.

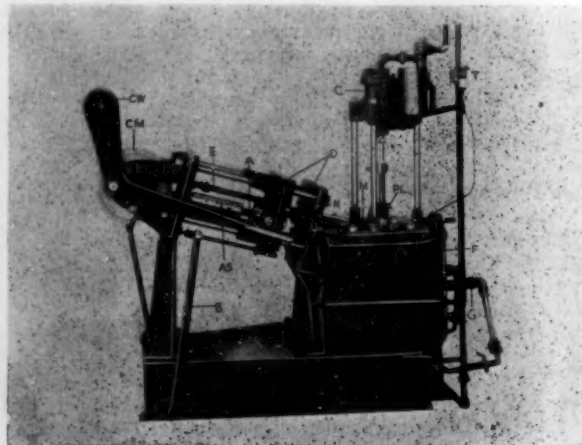
Die Casting Machines

Newton-New Haven Company of New Haven, Conn., have recently introduced their latest type pressure casting machines known as the No. 500 four bar machine. This is a heavy duty plunger type machine for the pressure casting of zinc and zinc base alloys.

In offering the latest machine a number of new features have been incorporated: added capacity of the machine, quick die mounting, increased speed of production with ease of operation and added safety.

With the four bar type there is far

Newton - New Haven
No. 500 4-Bar Machine



greater die capacity than on the former machines. Of the four sliding bars one is now removable to facilitate quick mounting of dies with automatic core pulls. Roller bearings have been included in the cam itself and both cam shaft bearings. A fourth bumper bar has been added at the bottom of the sliding bolster to facilitate ejection in over-hanging dies. Safety device has been incorporated to prevent operator making shot or pump until die is locked tight.

Machine is equipped with automatic temperature control of metal insuring proper casting temperature at all times.

The operator moves levers A and B during each casting operation. Other operations are automatic. The metal is melted in pot M by atmospheric gas burners G under thermostatic control T. Self-aligning dies are clamped to die bolsters D with T slots. Dies are closed and opened by lever A which turns cam CM. Casting operation is made by moving lever B to the left to operate the piston of air cylinder C. This piston drives plunger PL down and forces the metal into the dies through nozzle N. Castings are automatically ejected in the opening of the die when the ejector plate contacts adjustable bumper bars E.

Specifications: Length 8 ft. 6 in.; width, 3 ft. 7 in.; height, 5 ft. 9 in.; weight, 2,400 lbs.; die capacity, 9 x 12 in. x 9 in. thick; furnace capacity, 200 lbs. of metal; casting rate, 5 to 10 shots per minute.

New Industrial Alkali

In our March issue, page 104, we published a description of a new industrial alkali made by the Philadelphia Quartz Company, Philadelphia, called Metso 99. A typographical error appeared in this description which we hasten to correct. It was stated that one of the valuable properties of Metso 99 was the maintenance of pH until almost all of the alkali was "introduced." This statement should have read "until almost all of the alkali was neutralized."

Design Service

Bardone - Giovannucci, 113 West Avenue, Stamford, Conn., offers a design service to manufacturers which runs along in the following lines: a visit to the manufacturer's plant to thoroughly acquaint themselves with the construction of the article, learn the estimated manufacturing costs, what tools can or cannot be changed, what mechanical limitations, etc.

Riehle Brothers Testing Machine Company, Philadelphia, Pa., manufacturers of Riehle Testing Machines, has become a part of American Machine and Metals, Inc., according to an announcement issued by E. P. Holder, executive vice president of the latter organization. Abbott F. Riehle will continue as general manager with headquarters at the new executive office address—100 Sixth Avenue, New York City.

Catalogs

Udylite Plating Barrel. The Udylite Company, 1651 E. Grand Blvd., Detroit, Mich. (332)

Spray Painting and Finishing Equipment. Bulletin AD-114, a 2-color, 32 page booklet giving prices and descriptions of new additions to the Binks line including the Thor Model 5 touch-up gun, the Thor Model 6 touch-up and general utility gun and the No. 5 complete touch-up outfit. The booklet also includes helpful suggestions and technical information. Binks Manufacturing Company, 3114 Carroll Avenue, Chicago, Ill. (333)

High Temperature Box Furnace; electrically heated to 2300° F., using metallic resistor elements. Hevi Duty Electric Company, Milwaukee, Wis. (334)

Alundum Rubber Bonded Safety Tread. Norton Company, Worcester, Mass. (335)

Mapi Activities and National Problems. An Address by N. W. Pickering, president, Farrel-Birmingham Company, Ansonia, Conn., before the Machinery and Allied Products Institute at New York City, February 27, 1935. (336)

Social Security by Payroll Tax A Great Delusion. Wagner-Lewis Bill would reduce purchasing power, raise prices and increase unemployment. Farrel-Birmingham Company, Ansonia, Conn. (337)

Hydraulik Accumulators; also presses of all types and sizes for tube and rod extrusion. Seamless Steel Equipment Corporation, 39 Broadway, New York. (338)

Parker Valves. Bulletin No. 38; Price List. Parker Appliance Company, 10320 Berea Road, Cleveland, Ohio. (339)

Brasses. An attractive little book for manufacturers and engineers, with a brief selection from the large amount of information available on that subject. British Copper Development Association, Thames House, Millbank,

London, S. W. 1., England. (340)

Chains and Sprockets for Power Transmission, Conveying and Elevating. Catalog K-1. Baldwin-Duckworth Chain Corporation, Springfield, Mass. (341)

Motorized Reducers. Catalog No. 1515. Link Belt Company, 910 S. Michigan Avenue, Chicago, Ill. (342)

Industrial Power Transmission. A practical analysis of some fundamentals prepared by the Mechanical Power Engineering Associates, 370 Lexington Avenue, New York. (343)

The Louis Allis Messenger. A bi-monthly, 24 page company magazine for those interested in the purchase or maintenance of electric motors. Louis Allis Company, Milwaukee, Wis. (344)

Data Sheets on the Latest Developments in Anti-Friction Bearings. The Bearing Appliance Company, Ardmore, Pa. (345)

Norbide Pressure Blast Nozzles. Made of Norton Boron Carbide. Norton Company, Worcester, Mass. (346)

Masters of Metal. A booklet which tells as quickly and comprehensively as possible the story of Scovill, its divisions and subsidiaries, and the various ways in which they can be of service to industry. Scovill Manufacturing Company, Waterbury, Conn. (347)

Mallets and Mauls; made of lignum vitae, hickory and dogwood. Lignum Vitae Woodturning Company, 96-100 Boyd Avenue, Jersey City, N. J. (348)

Tinplate and Canning in Great Britain. An 82-page bulletin giving the results of an exhaustive survey of progress in canning and tinplate manufacture in Britain and touching some aspects of developments in the United States and other countries. International Tin Research and Development Council, Manfield House, 378 Strand, London, W. C. 2, England. (349)

Save time. Use the coupon below to get any of the above catalogs or bulletins, or for data on any subject not mentioned this month. METAL INDUSTRY will see that you get them promptly.

METAL INDUSTRY

(Insert below the number in parentheses at end of each item desired.)

116 John Street, New York.

I wish to receive the following catalogs mentioned in April, 1935

Name Address

Associations and Societies

American Electroplaters' Society

1935 Convention, Bridgeport, Conn., June 10-13.

A full report from all committee chairmen shows that this year's Convention and Exhibition will be fully successful in all respects. The following is an outline of the progress made.

Educational. A very fine and varied educational program has been arranged. It is much more ambitious than has been attempted in previous years, in that every angle pertaining to the industry will be covered.

Program. The response on program advertising has been most gratifying, and the program booklet will be most complete and worth while. This will be sent out in advance to the entire membership of the American Electroplaters' Society.

Visits. Especially interesting to all those attending the convention will be the plant visits which have been arranged to some of the leading industries of New England. Visitors will be shown actual manufacturing processes all the way from the metal in its raw state to the finished product. The rolling processes in some of these plants are most spectacular and we are very glad to be able to offer convention guests this unusual opportunity to tour these fine plants.

Transportation. The railroads are furnishing special convention rates to those attending the convention provided that the certificates are properly filled out.

Ladies. A large local committee is working out plans for the entertainment of all our women guests and they can be assured of a truly enjoyable visit and a "good time."

Exhibition. For the first time in the history of the Society, a separate exhibition has been arranged in connection with the convention, and that this exhibition will be a real success is assured by the wonderful response from all over the country. It promises to be one of the outstanding features of the Convention. It will be held in a building separate from the hotels.

Outstanding Exhibits

1. A complete display of the latest, and most modern, equipment of degreasing machinery.
2. The outstanding products of metal finishing, lacquers and enamels, many of them recent developments.
3. New filtering units of the latest designs—something not exhibited before.
4. The latest type of tumbling mills for small and large parts.
5. Small plating units in operation by several outstanding manufacturers showing new methods and materials employed.
6. The first public demonstration of a new method, by the use of a small unit, showing how scale, oxide, and other foreign elements, can be economically removed from metal parts, prior to plating or grinding.

7. Displays of motor generating sets, polishing lathes, electrical appliances and automatic plating units developed during the past three or four years.

8. Cleaning materials. The latest and most economical preparations developed to date.

9. Equipment for plating, electro-galvanizing, cleaning, pickling, acid-dipping, neutralizing, rinsing, drying and allied operations.

10. The outstanding manufacturers of abrasives have taken space for the purpose of demonstrating their products.

11. A new coating system (Metalayer) which is capable of spraying metal of any kind that can be drawn into wire with the necessary adjustments to accurately control the thickness of the metal deposited.

There are still available approximately twenty-five booths. There is certain to be a public audience made up of men from New York, New Jersey and New England Industries, to visit the Tercenary of thousands of people, in addition to the 600 to 800 men who will register at the convention from all over the United States.

Those interested in securing space will please address their communications to R. T. Phipps, Manager of Exhibits, 271 Grovers Avenue, Bridgeport, Connecticut.

Additional Exhibitors

The following firms have contracted for space since the publication of our March issue:

Oakite Products, Inc., 22 Thames Street, New York.

Chromium Corporation of America, 120 Broadway, New York.

Carborundum Company, Niagara Falls, N. Y.

Matchless Metal Polishing Company, 726 Bloomfield Avenue, Glen Ridge, N. J.

MacDermid, Inc., Waterbury, Conn.

J. C. Miller Company, Grand Rapids, Mich.

U. S. Galvanizing and Plating Equipment Corporation, 32 Stockton Street, Brooklyn, N. Y.

Atlas Powder Company, Wilmington, Del.

Yankee Products Company, Bridgeport, Conn.

MacFarland Manufacturing Company, 21-03-41st Avenue, Long Island City, N. Y.

Bullard Company, Bridgeport, Conn.

Detroit Branch

c/o T. C. Eichstaedt, 77 Pingree Avenue, Detroit, Mich.

A regular meeting of the American Electro-Platers Society, Detroit Branch, was held on Friday evening, March 1st, at 8:00 P.M., at Hotel Statler.

There were four applications for membership as follows:

George Lodge, 2100 Hubbard St., Detroit, Mich.

Roy Wayne Rapp, R.F.D. No. 1, Wyandotte, Mich.

Russell Raab, 3204 Helen Ave., Detroit, Mich.

Frank J. Gach, 6628 Willette, Detroit, Mich.

Col. Hansjosten read a letter from the Supreme Society, asking Detroit Branch to take a vote on the Resolution passed by the convention held in Detroit in June, 1934. This was a resolution for an amendment to the Constitution regarding taking in Assistant Foremen as Active Members to the Society. The Detroit Branch took a vote to support this Amendment.

Another resolution, moved, supported and carried was that the Detroit Branch go on record as being opposed to the suggestion for an Amendment to the Constitution creating firm memberships.

The Speaker of the evening was then introduced. James Higgins, Chemist of the Packard Motor Car Company, spoke on the subject of "Zinc Plating". The paper was very interesting, educational and very well read, and called forth quite a lot of discussion. His paper will be published in the near future in the Monthly Review.

Connecticut Non-Ferrous Foundrymen's Association

Care of L. G. Tarantino, 523 W. Taft Avenue, Bridgeport, Conn.

A regular monthly meeting was held on March 19th at the Hotel Garde in New Haven, presided over by J. T. Judge, Jenkins Bros. Company, Bridgeport. The meeting was devoted to a round table discussion of non-metallic fluxes which was led by David Tamor, president of the Association.

A meeting will be held on April 16th at the plant of the Bristol Company at Waterbury, Conn. This company will serve dinner to the members and a talk will be given on the application of precision instruments in foundry practice.

A meeting will be held on May 21st at the Hotel Garde in New Haven and will be addressed by R. J. O'Connor of the Contract Plating Company in Bridgeport, on the subject of Polishing, Buffing, Acid Dipping and Finishing of Brass and Bronze Castings.

American Zinc Institute

60 E. 42nd St., New York

The 17th annual meeting of the American Zinc Institute will be held at the Hotel Statler, St. Louis, Mo., April 22 and 23.

One of the meetings will be given over entirely to the industry's galvanizing campaign, its accomplishments, its failures and its futures. Full details can be obtained from the headquarters of the Institute.

Personals

R. H. Leach

R. H. Leach, Manager of Research and Development, Handy & Harman, Bridgeport, Conn., is one of the prominent figures in the Committee work of the American Society for Testing Materials. He received his B.S. degree from Massachusetts Institute of Technology in 1900. Subsequently, he was in charge of various mining and



ROBERT H. LEACH

metallurgical operations in Idaho, South Dakota, Michigan and British Columbia, and since 1914 has been with his present company. In addition to his interest in the work of Committee B-2 of the American Society for Testing Materials on Non-Ferrous Metals and Alloys, of which he is the vice-chairman, he is a member of Committee E-1 on Methods of Testing and E-2 on Spectrographic Analysis.

Ralph M. Roosevelt has resigned from the post of vice-president and manager of the New York office of the Eagle-Picher Lead Company, in order to devote all of his time to the affairs of the American Zinc Institute, Inc., 60 E. 42nd Street, New York, of which he is president.

Willard E. Maston, vice-president and general manager of sales of the Eagle-Picher Lead Company, Temple Bar Building, Cincinnati, Ohio, will transfer his headquarters from Cincinnati to New York, at 420 Lexington Avenue. F. W. Potts, vice-president of the Company has been appointed general manager. John R. MacGregor, vice-president, will have charge of sales research and product development. T. C. Carter has been named director of sales.

Dr. Bruce A. Rogers has been appointed to the technical staff of Battelle Memorial Institute, Columbus, Ohio. Dr. Rogers comes to Battelle from the National Bureau of Standards, and will work on a new program of research relating to the automotive industry.

Myron R. Nestor, and Philip C.

Rosenthal have been appointed to the technical staff of the Battelle Memorial Institute.

Carlos M. Heath has been appointed assistant metallurgist on the staff of Battelle Memorial Institute of industrial and scientific research, Columbus, Ohio. Prior to joining the Battelle staff Mr. Heath held a position in the metallurgical department of the American Brass Company at Waterbury, Conn. Mr. Heath has been assigned work in connection with a new metallurgical project in the non-ferrous field.

John A. Honnecker, formerly with the Durham-Duplex Razor Company, where he held a position as supervisor of the metal finishing division, has joined the sales force of the Frederick

Gumm Chemical Company 113-15 36th St., Union City, N. J. He will represent that organization in New York State.

Wilfred S. McKeon, President of Sulphur Products Co., Inc., of Greensburg, Pa., returned to New York from a combined business and pleasure trip to the Bahamas, Jamaica, and Cuba. While in Havana "Liquid Sulphur Mac" made his headquarters with his agent Jose Diana, Obrapia 79. But the revolution got too hot for "Mac" and he had to leave before having the pleasure of meeting President Mendieta. In order to make his time spent in Cuba a little exciting some of the revolutionists tossed a bomb at a street car on which "Wilfred S." was a passenger. He says "If you want to appreciate the value of our flag; get out from under it sometime."

This Greensburger says business in Cuba will be very good in about 60 days.

Obituaries

Henry S. Wardner

Henry S. Wardner, treasurer and general counsel of the New Jersey Zinc Company, died March 5, 1935 of a heart ailment at his home 11 E. 68th Street, New York. Mr. Wardner was at one time a member of the law firm of Strong and Cadwalader, now known as Cadwalader, Wickersham and Taft. He left this firm to join the New Jersey Zinc Company with whom he remained all his life.

Mr. Wardner was a keen student and an authority on New England history.

Charles Bauer

Charles Bauer, general manager and secretary of T. E. Conklin Brass & Copper Company, 54 Lafayette Street, New York, died on March 25th at his residence, 154 Ridgewood Avenue, Brooklyn, N. Y., after an illness of about seven weeks. He was in his 57th year.

Mr. Bauer had been with the Conklin Company nearly half a century, having joined the organization Aug. 1st, 50 years ago as an office boy. Through his long association with the copper and brass products business, he was known throughout the industry, particularly on the eastern seaboard.

Besides his widow he is survived by three daughters, Miss Helen Bauer, Mrs. Wesley Anderson and Mrs. Martha Balfour.

James F. Leahy

James F. Leahy, general superintendent of the Buffalo (N. Y.) plant of the Farrel-Birmingham Company, Inc., died at his home in Kenmore, N. Y., on Wednesday, March 6, 1935, after a month's illness.

Mr. Leahy was born in Torrington, Conn., October 23, 1870, and resided in

Ansonia for 22 years, where he had been in the employ of the Farrel company since December 2, 1901. He had served as machine shop foreman at the Ansonia plant before being transferred to the superintendency at Buffalo 12 years ago. He was held in high esteem by the concern with which he had been connected for so many years, both for his mechanical skill and as an executive.

Mr. Leahy is survived by his wife. Funeral services were held from his late residence and from St. John the Baptist R. C. Church in Tonawanda, N. Y. on Saturday morning, March 9th.

Samuel Moore

Samuel Moore, one of the oldest manufacturers of jewelers' findings in the United States, and nationally known as an inventor of freight and passenger car wheels, shoe nails, twist drills, shot chain machinery, fancy and figured wires and stock for jewelers' use and numerous other things, died February 22 at his home 38 Mawney street, Providence. He was in his 91st year. He retired eight years ago as active head of Samuel Moore & Company, 301 Friendship street, Providence, the business having since been conducted by his son, S. Lindley Moore.

He was born in Falmouth, Mass., September 11, 1844 the son of Prince Gifford and Charity (Swift) Moore, his parents being among the earliest Quakers of New England. He attended the Lawrence (Mass.) Academy and at the age of 18 went to Taunton, Mass., to learn the machinist trade.

In 1885 he started in as a manufacturer of jewelry and silversmith's supplies at 227 Eddy street, Providence, removing in 1904 to the plant 301 Friendship street which has been occupied ever since.

He is survived by his wife, son, three daughters and six grandchildren.

W. H. M.

Industrial and Financial News

News of the Codes in the Metal Industry

NON-FERROUS FOUNDRY INDUSTRY

Headquarters, 47 Fulton Street,
New York

A meeting of the Code Authority for the non-ferrous foundry industry was held at the Hotel Cleveland, Cleveland, Ohio, February 18-19. Collections of the Code Authority assessments are over 60 per cent of the amounts billed and expenses are considerably less than those provided for in the budget. Consequently the rate of assessment will be lower in 1935.

After serious consideration of the question of employing minors, the Code Authority recommended that no foundry employ anyone under the age of 18 in any operation in the plant.

The matter of flat price quoting was a subject of considerable discussion. It is the plan of a Committee of the Code Authority to show by actual cost studies that selling at a flat price means losing money on small jobs and intricate jobs

in the hope of making it up on heavy jobs and simple jobs.

The Aluminum Permanent Mold Division has prepared and adopted a set of standard trade customs.

The question of overlapping of the foundry code with other codes was discussed at length. At the present time the Code Authority is in contact with the Code Authorities of the architectural and ornamental industry, the marine equipment industry, aluminum wares industry and the fabricated metal products industry, and is making efforts to set up definite lines of demarkation.

ALUMINUM INDUSTRY

All of the fair trade practice provisions of the aluminum code were suspended on March 21st by the National Industrial Recovery Board after a ruling that the code has not operated to protect small enterprises from oppression or discrimination, nor has it aided to effectuate the policy of Title I of the

National Industrial Recovery Act. The Board's order applies principally to Article IX of the Code which deals with differences in prices charged to controlled companies and other purchasers.

ELECTRO-PLATING INDUSTRY

The N. I. R. B. has approved the selection of **Dr. Wm. Blum** of the National Bureau of Standards of Washington, D. C., and **Carl E. Heussner** of the Chrysler Corporation, Detroit, Mich., as Consumer Representatives on the Committee on Standards of Quality of Electroplated Coatings.

ZINC INDUSTRY

The Code for the zinc industry was approved by the N. I. R. B., effective April 8th. It provides a basic maximum working week of 40 hours and an 8-hour day. Minimum wages range from 30 to 47½ cents an hour.

A provision is included for possible suspension or amendment of the Code after a trial period of three months.

Metal Developments

Corporation Earnings

Net profit unless followed by (L) which is loss.

	1934	1933
Aluminum Goods Manufacturing Company	\$551,165	\$52,735
Aluminum Industries, Inc.	69,691	100,207
American Hardware Corporation	244,364 (L)	268,542 (L)
American Machine & Metals Company	28,042	62,011 (L)
American Radiator and Standard Sanitary Corp.	1,455,227	881,575
American Smelting & Refining Company	7,583,202	6,010,384
Anaconda Copper Company	1,960,093	6,822,115 (L)
Colt's Patent Firearms Manufacturing Company	577,824	675,132
General Cable Company	526,078 (L)	2,044,186 (L)
General Electric Company	19,726,044	13,429,739
General Refractories Company	1,116,312	546,783
Gorham Manufacturing Company	214,292	238,023
Hajoca Corporation	199,181 (L)	470,482 (L)
Hamilton Watch Company	289,641	148,560 (L)
International Nickel Company	18,487,478	9,662,583
International Silver Company	206,183	242,623
Keystone Watch Case Company	163,897	52,877 (L)
Landers, Frary & Clark	514,165	236,409
Manning Bowman & Company	652	30,074 (L)
National Cash Register Company	1,115,631	579,623 (L)
New Haven Clock Company	98,560	126,870 (L)
Phelps Dodge Corporation	3,224,914	83,568 (L)
Plume & Atwood Manufacturing Company	165,390	125,637
Pyrene Manufacturing Company	91,925	103,151 (L)
Remington Arms Company	142,589	1,492,629 (L)
Revere Copper & Brass, Inc.	1,011,101	406,100
Reynolds Metals Company	1,642,461	1,446,638
Scovill Manufacturing Company	730,576	305,688
Sperry Corporation	1,878,104	455,818*
Vulcan Detinning Company	262,113	304,421
Waltham Watch Company	315,350 (L)	69,461 (L)
Waterbury Clock Company	127,278	15,516
Western Electric Company	7,751,548 (L)	13,772,504 (L)
Weston Electrical Instrument Company	101,720	24,369
Westinghouse Electric Manufacturing Company ..	189,562	8,636,841 (L)
Yale & Towne Manufacturing Company	59,889	36,307

*Ten Months.

An interesting industrial film has been produced entitled "**The Development of the Lathe.**" It traces the history of this basic machine tool from the year 500 to the present day. Those who are interested can get full information from W. E. Whipp of the Monarch Machine Tool Company, Sidney, Ohio.

Counterfeiters have gone into the small change business. Early in March the New York police captured the plant of a group of counterfeiters who had manufactured about \$250,000 worth of synthetic nickels made of a low grade of nickel silver.

An **Industrial Arts Show** will be held in New York, April 15 to May 15th by the National Alliance of Art and Industry at the Rockefeller Center Forum. Leading industries of the country catering to the consumer, will be represented in the display. The **American Brass Company** will demonstrate the economy and architectural possibilities of rust proof metal building materials and equipment, such as brass pipe, copper tube and fittings, copper leaders, gutters and spouting, copper and bronze screen cloth, copper roofing, enameled copper tile, bronze and Ambrac grilles and welded Everdue hot water storage tanks; also the variety of uses on Anaconda electro sheet copper such as for roofing, damp and weather-proofing in extremely thin form (3/16 of an ounce per sq. ft.), with paper backing for wall paper.

According to an estimate from B. J. Flynn, Director of the Industrial Divi-

sion of the Federal Housing Administration, more than 750,000 stores need repairs such as new fronts, etc. A two-billion dollar market exists in this field which the Housing Administration intends to stimulate. It is expected that a large number of such repairs will include the specification of copper alloys and other rust-proof materials.

Nickel silver will take the place of parchment for the diplomas for the Missouri Schools of Mines and Metallurgy at Rolla, Mo. The diplomas are to be nickel-silver plates 5" x 8", No. 20 gauge. The signatures will be etched and oxidized and lacquered to protect the finish.

At a recent meeting at the Massachusetts Institute of Technology, Dr. R. J. Van de Graaff, associate professor of physics gave a demonstration of transmutation. By the use of a 1,200,000 volt charge, he was able to change silver to cadmium.

The Baldwin Locomotive Works, Philadelphia, Pa., which is at this time in process of reorganization, has as one of its departments, one of the largest non-ferrous foundries in the United States.

In the case of the suit against the Aluminum Company of America by the Baush Machine Tool Company of Springfield, Mass., for alleged monopolistic practices, a jury in Hartford, Conn., brought in a verdict of \$956,300 against the Aluminum Company. Judge Harland B. Howe, immediately trebled this award to \$2,868,900 under the terms of the Sherman Anti-Trust Law. In addition the Aluminum Company was assessed \$300,000 for counsel fees for the Baush company, and was ordered to furnish a bond for \$3,300,000. The Aluminum Company has filed notice of appeal against this verdict.

The Zephyr, the high speed train of the Chicago, Burlington and Quincy R. R. is made largely of stainless steel but it also includes a wide variety of metals and finishes in its construction. Parcel racks, serving trays and seat frames are made of aluminum anodically treated and satin finished. Body hardware is chromium plated; end and side tables in the lounge are edged with filigree stripes of polished aluminum. Lounge chairs have scratch brush finished aluminum arms and frames and serving trays and ash trays are made of aluminum. Coach seats are of scratch brush finished aluminum. Counter tops and guard rails in the pantry kitchen and kitchen annex have filigree stripes of polished aluminum. Counter stools have chromium plated tops and satin finished aluminum pedestals. In the dinette serving trays are made of anodically treated aluminum. Aluminum is used extensively in the air brake equipment to reduce weight. Copper pipes with sweated fittings have been used in the air-conditioning installation.

Business Items-Verified

Copper and Brass Research Association has moved its offices from 25 Broadway to 420 Lexington Avenue, New York.

Keystone Chromium Corporation, 1095 Niagara Avenue, Buffalo, N. Y., reports an increase of production and employment of 15% during 1934 as compared with 1933.

Cedarburg Manufacturing Company, Cedarburg, Wis., producer of small electric motors, metal stampings, etc., is adding a new line of light, low-priced outboard engines. This concern operates the following departments: brass machine shop, tool room, stamping, soldering, brazing, polishing, lacquering, japanning.

National Copper Paint Company, 666 Lake Shore Drive, Chicago, Ill., has been organized to manufacture and market a newly evolved liquid paint. H. M. Rice is president, C. L. Welch, executive vice-president, F. A. McLauchlan, secretary and treasurer. A plant has been established in Chicago with about 50,000 sq. ft. of manufacturing plant with L. D. Pangborn as plant manager. The items manufactured by the company are liquid copper paint, liquid copper primer and liquid copper reducer to thin out the paint for spray purposes. The paint contains 98.3% pure copper.

United Chromium, Inc., has removed its Detroit office and laboratory to larger and more conveniently located quarters at 2751 E. Jefferson Avenue, Detroit, Mich. The laboratory will contain new equipment and ample room for expansion.

New York Brass Foundry Company, 405 Broome Street, New York City, is contemplating installing a plating plant, and would appreciate complete information on equipment and supplies.

Bridgeport Deoxidized Bronze and Metal Company, Bridgeport, Conn., incorporated, capital \$50,000; per \$100; paid, \$1,000; to manufacture brass, bronze, aluminum, nickel silver castings. The following departments are operated: bronze, brass, aluminum foundry; casting shop.

American Platinum Works, 231 New Jersey R. R. Avenue, Newark, N. J., has let contract for one and two-story addition. Cost over \$30,000, with equipment. The following departments are operated: smelting and refining; spinning, stamping.

McCallum-Hatch Bronze Company, Inc., Buffalo, N. Y., has acquired the business of William H. Barr, Inc., Buffalo, manufacturers of brass, bronze, copper and aluminum castings. The new company will include the same personnel and staff as the old company. The general office will be continued at 27 Carolina Street, and the foundry at 243 Fourth Street, Buffalo. The officers of the new company are: John C. McCallum, president and treasurer; James

A. Hatch, vice-president and sales manager; Wm. F. Hagedorn, secretary.

The Hobart Manufacturing Company, Troy, Ohio, has purchased the Troy Match Plate Company, and is now operating this foundry, producing non-ferrous metal castings.

Consolidated Brass Company, Detroit, Mich., has elected Clarence C. Mosack, former secretary and assistant treasurer, president, and Homer D. Coleman, former president was named chairman of the board. Mr. Mosack has been with the firm 16 years and before that was connected with the American Lubricator Company before its merger with Sterling & Skinner Mfg. Company. Other officers named by the board were: G. H. Kirchner, vice-president; A. Bodde, secretary and treasurer, and F. R. Leffler, assistant secretary and assistant treasurer. The firm operates the following departments: brass foundry, brass machine shop, tool room, casting shop, stamping, plating, polishing and grinding room.

Dunck Tank Works, Inc., 2426 N. 30th Street, Milwaukee, Wis., specializing in brewery vessels, has placed contract for an addition, 40 x 62 ft., part one-story and basement.

The American Brass Company, Waterbury, Conn., will also take space at the Informashow, the annual exhibit of the National Association of Purchasing Agents, to be held May 20-23 at the Waldorf-Astoria, New York City. This exhibit will include Anaconda copper, brass, bronze, nickel silver and special alloys in all forms, and also Anaconda electro-silver sheet copper, the new thin sheet copper.

The U. S. Galvanizing & Plating Equipment Corporation, 32 Stockton Street, Brooklyn, New York, on May 1st, 1935, will move their Main Office and Plant to 27-41 Heyward Street, Brooklyn, New York, which will provide increased space and improved facilities for their line of manufacture. They specialize in the development and manufacture of fully automatic, semi-automatic and manually operated equipment and apparatus for plating, cleaning, drying and allied operations.

Industrial Cleaner Exhibit

One of the elaborate displays which will be shown at the exhibition will be that of Oakite Products, Inc., 22 Thames Street, New York. Sample units of a wide variety of plated work will be shown; also a practical working demonstration of Oakite Saturel, a process for the cleaning of cold rolled steels and other metals in which carbon smuts and insoluble dirt are encountered. The booth will be under the direction of H. C. Duggan assisted by C. E. Barber, L. E. Miller, F. W. Reese, F. E. Allen, P. M. Cunningham and A. A. Kopp.

News From Metal Industry Correspondents

New England States

Waterbury, Connecticut

April 1, 1935.

Employment fell off slightly in February but all other local business indices were higher for the month than for the same month last year. Employment in all concerns having 65 or more persons was 28,970, or 31 less than a year ago and 95 less than in January. In the eight largest factories there were 15,387 employed, a decrease of 195 compared with February last year but a decrease of but one compared with this January bank clearings were \$485,000 ahead of February last year and bank savings \$1,397,955 higher. Electric consumption showed an increase of 420,571 kilowatt hours as compared with the former year. Postal receipts were \$3,546 more than last year.

The **Waterbury Buckle Company** and six other firms making "pin tickets" such as are used for price markings, have been charged with conspiracy in restraint of trade by the Federal Trade Commission.

The RFC has agreed to increase its loan to the **Beardsley & Wolcott Manufacturing Company** from \$60,000 to \$85,000 to permit it to reorganize.

The concern is now working full time with 145 employees. **Lyall Brown**, trustee, says that an arrangement has been made with the **Garrison Engineering Company** of New York whereby fire extinguishers will be made at the local plant for the New York firm and as a result extra help will be employed.

A report that the **Waterbury Clock Company** had laid off between 1,000 and 1,500 employees during the last month is denied by **President James R. Sheldon**. Because of the normal slackening off at this time, some employed have been laid off, but he said it did not amount to more than a few hundred. He said he fully expects business to pick up again within the coming month and that present conditions are encouraging.

The **American Brass Company**, **Scovill Manufacturing Company**, **Chase Companies, Inc.**, and **Waterbury Button Company** will have exhibits at the **Inform-a-Show** in connection with the convention of the **National Association of Purchasing Agents** in New York, May 20 to 23. Other firms to have exhibits will be the **Bridgeport Brass Co.**, **Royal Typewriter Company** of Hartford and **Wallace Barnes Company** of Bristol.

W. R. B.

Connecticut Notes

April 1, 1935.

HARTFORD—The **National Labor Relations Board** has recommended that the **Blue Eagle** be removed from the **Colt's Patent Fire Arms Manufacturing Company** as a result of the strike of

some thousand employees. The board some time ago issued an ultimatum to the company to agree in writing to bargain with the joint shop committee at **Colt's** and recognize the committee as officers of the union. As a result of the alleged failure of the company to comply, most of the employees went on a strike last month. The company says 350 are still at work but the strikers say there are but 50. The strikers are picketing the plant but there are no disorders.

MERIDEN—The **Bradley & Hubbard Company** has obtained a loan of \$150,000 from the Federal Reserve bank of Boston, payable Dec. 15, 1939.

BRIDGEPORT — The **Remington, Rand, Inc.** will build a one story factory, 80 by 300 feet here. Estimated cost is \$50,000.

NAUGATUCK—The **Diver Manufacturing Company** has incorporated and established a plant on Elm Street. It will manufacture collapsible ladders and accessories, brass and steel novelties. The capital stock is set at \$50,000 and the working capital is \$26,000. The incorporators are: **Arthur H. Diver**, **Edwin K. Diver**, **Margaret C. Diver** and **Edward J. Diver**.

W. R. B.

Providence, R. I.

April 1, 1935.

Statistics just released in a report by the **United States Bureau of Census** regarding the manufacturing establishments in Rhode Island are particularly

interesting and significant as regarding the metal trades and appurtenant industries. A total of 1,254 manufacturing establishments in all lines of industry in Rhode Island reported as employing in 1933, a total of 92,512 employees whose annual wages amounted to \$76,123,742. The products manufactured were valued at \$331,046,401. This was a reduction of 3.1 per cent in the number of employees; 20.7 per cent in the amount of wages paid and 19.2 per cent in the value of production. In 1933 there were reports from 215 concerns identified with the metal and allied trades, as compared with 240 in 1931, the year with which all comparisons are made in the census returns. These, in 1933 employed a total of 6,882 persons receiving wages aggregating \$5,311,338 and producing goods valued at \$21,107,679.

The **Manville Metal Company** of 225 Pine street, is owned by **Thomas J. Manville**.

The **Miltonberg Jewelry Company** of 85 Sprague street, is owned by **Albert Weiner**, doing business as **The Albert Manufacturing Company** at the same address.

John Suter, who has been employed in the polishing department of **The Gorham Manufacturing Company** for 39 years, and **Frank E. White** for 33 years in the bronze department, have been retired on pension.

The **William H. Haskell Manufacturing Company** of Pawtucket has filed a statement with the Secretary of State's office that its capital stock has been reduced from \$1,000,000 to \$755,800.

—W. H. M.

Middle Atlantic States

Utica, N. Y.

April 1, 1935.

Definite signs of business acceleration in Central New York were seen as the metal industries in this area went into the spring season. New products were being planned and some orders had started to come in.

Increase in employment and payrolls in Utica for 22 business days in February against 26 in January is shown in the figures compiled by the New York State Department of Labor. Increase was also shown in Utica in the consumption of industrial gas and electricity. Employment was 88.4 per cent of normal for the four major industries, an increase of 5.1 per cent over January, while hours of labor increased in the same proportion.

The **Savage Arms Corporation** in Utica started manufacture of a new line of goods, **Zephyr** air conditioning equipment. A separate department has

been set up in the factory giving considerable additional employment. All equipment with the exception of a small motor will be manufactured in Utica. The equipment is to be made for use in homes, offices and public buildings. **W. D. Jordan** of the corporation's New York office will be sales manager of the air conditioning department and **Clinton Baldwin**, works manager, will direct construction.

In Utica the **Foster Brothers Manufacturing Company** began the manufacture of a new type of bed spring in which aluminum finished metal parts is a feature. Each bedspring has 99 coils constructed with two turns to the coil which offers a double amount of spring wire at the top in contact with the mattress. The new spring with its added features for comfort is expected to increase business.

Charles Millar & Son, Utica, Central New York's largest plumbing supply house held its spring sales conference

at Hotel Martin where more than 100 dealers were present. Working in co-operation with the Utica firm was the **F. E. Myers & Brother Company** of Ashland, Ohio, who demonstrated the installation and servicing of water pumps and water systems.

Dr. George Barton Cutten, president of **Colgate University**, revealed his hobby in a Utica address recently. He is collecting the work of the early silversmiths in Central New York.

—E. K. B.

Newark, N. J.

April 1, 1935.

Several industrial concerns have threatened to move from Newark because of increased taxes and some have already received invitations to locate in nearby towns. The **Walworth Company** valve makers, whose personality tax was increased from \$10,000 to \$25,000 in Newark, already has moved from Newark and has begun operations in Harrison. Officials of the company declare that high taxes forced the removal.

Metal industries are looking for a good spring trade because of the increase for plumbing and other supplies. Orders for these supplies are said to be about 25 per cent above those of last year.

Following Newark concerns have been incorporated; **Vulcan Lamp Works**, incandescent lamps, 1,000 shares, no par; **Chelsea Laboratories, Inc.**, chemicals, \$125,000; **William C. Keyworth Company**, chemicals, \$125,000; **Essex Maintenance Company**, oil burning equipment, 2,500 shares, no par.

Mechanics employed in the construction of the new plant for the **Titanium Pigment Company** at Sayreville, N. J., who have been on strike, have returned to their jobs pending arbitration on the wage scale disagreement which caused the walkout. The walkout included 140 men.—C. A. L.

Trenton, N. J.

April 1, 1935.

A slight upward trend in factory employment in New Jersey during January is shown in the monthly compilation of employment and wages by the Department of Labor. Employment increased 2.5 per cent and weekly payrolls 2.4 per cent, though average weekly earnings decreased 1 per cent. Metal products, other than iron and steel, was the only group among the durable goods industries showing an increase for the month in both employment and payrolls. Chemicals reported a decrease of 2.1% in employment and 1.5% in payrolls.

Austin C. Cooley, 62 years old, secretary, assistant treasurer and a director of the **John A. Roebing's Sons Company**, narrowly escaped death in February when his automobile plunged down a 50-foot embankment and dropped into the Delaware River on the Pennsylvania shore near Trenton. He was rescued from his submerged car by five men and taken to Mercer Hospital, where he was a patient for some time. He suffered shock and submersion.—C. A. L.

Middle Western States

Toledo, Ohio

April 1, 1935.

Industry in this area is making steady progress. Manufacturers of motor car parts are making the heaviest shipments they have since back in 1929. While other lines in which non-ferrous metals are concerned are showing progress, they are hardly up with the motor car industry which is outstripping everything in the way of production.

The plating plants are active, most of them in this area having about all they can handle. Some are working over time.

Fifty-one major plants in Toledo, mainly automotive, reported more than 20,000 workers on March 1. This is probably the highest employment in more than four years.—F. J. H.

Detroit, Mich.

April 1, 1935.

Industrial activity in this area is making steady progress. The non-ferrous metals are doing better than they have in the last two or three years. Most of this activity is directly related to the motor car industry with the major plants here deep in Spring production. No one

knows how long this will continue but it looks as if present activities might continue for many weeks.

Accessory plants and parts manufacturers also are speeding to keep up with demands, many being forced to work over time. Plating plants also are busy.

The outlook is not so favorable for many other lines of industry. Manufacturers of plumbing supplies are struggling along but their progress is slow. Manufacturing jewelers are doing a little better, but they have a long way to go before they can be said to be prospering.

The refrigeration industry has great promise for the coming summer. The plants have been active for months but now, with business conditions so much improved, manufacturing schedules are sure to be greatly increased.

The production of vacuum cleaners also is steadily on the increase.

David E. Anderson, chief engineer of the **Bohn Aluminum & Brass Corporation**, is in Europe for several weeks studying engine design, particularly as related to combustion chamber and cylinder head practice. The trip is in connection with research work which the Bohn organization is conducting in connection with engine designing.—F. J. H.

Pacific States

Los Angeles, Calif.

April 1, 1935.

The 100 inch telescope mirror's face has been rejuvenated at Mt. Wilson, Pasadena. It has been coated with aluminum, rather than silver and is one third more powerful. This aluminum process was developed by **Dr. John Strong**.

A local Exposition building is being erected on Fairfax Ave., near Wilshire Boulevard, which will have a comprehensive exhibit of all kinds of metal products, especially for the building trades. **C. W. Henderson** is general manager.

Edward Schill has had on exhibition some very fine silver work, done at his place, 1602 Cosmos St., Hollywood.

The **Scheu Company** at the Consolidated Building, this city, have gone quite extensively into the making of orchard heaters.

The **Thurston Pen Company**, of this city, are making a new leak proof fountain pen, which has a control valve, a self cleaning plunger and vacuum filled.

James R. Fouch has invented a new radio microsphere which is being manufactured by the **Universal Microphone Company** of Inglewood, to cost \$10 to \$500; also making microsphere adjustments for the deaf to be used in theatres. Microphones are also being built to attach to the coat lapel or watch case, which will pick up casual conversation from nearby people.

The **Oil Pure Refiner Company** of 308 North San Fernando Road, Glendale,

are making a small metal oil filter for autos, trucks and buses, which refines and filters the oil.

The **Boyle Manufacturing Company**, of 5100 Santa Fe Ave., have built an addition to their plant, to manufacture all kinds of metal ware, also truck and trailer tanks and bodies.

The **Hobbs Battery Company** have built a large factory at 711 East 14th St., for the manufacture of auto batteries.

The **Lansing Manufacturing Company** have moved to larger quarters, to 6900 McKinley Ave., to manufacture loud speakers.

The **Magnetic Signal Company** of 3355 East Slauson Ave., have started making portable drinking fountains.

The **L. & N. Company** of 2016 Bellvue St., are making a metal light container, to kill ants.

The **Mulford Manufacturing Company** of 2325 East 15th St., are making a new automatic bilge bailer for boats, which is made of copper.

The **Thermador Electrical Manufacturing Company** of 116 Llewellyn St., have started making electric heaters for houses, apartments and hotels.

The **Ward Refrigerator Manufacturing Company** of 6501 South Alameda St., have gone into larger production of ice refrigerators and are exporting quite a large amount.

Morey & Jones of 972 South Henlock St., are making a new electric flow meter, to measure air, gas, steam, water and other liquids.—H. S.

Metal Market Review

April 1, 1935.

Copper was unchanged in price throughout the month but the atmosphere was decidedly clearer. Sales abroad were more active with prices firm. The most encouraging feature was the fact that the long awaited conference of producers throughout the world, after three weeks of negotiations and discussions, reached an accord on limiting production outside of the United States and establishing new fair trade practices in foreign markets. This agreement which takes effect at once, involves a cut of about 20% in output, with South American and African producers probably reducing their operations by as much as 30%. This should bring world production fairly closely in line with consumption.

Zinc was steady at 3.90 for Prime Western, East St. Louis, practically the entire month. Stocks of zinc in the United States were reduced during February by 1,831 tons from the previous month. Demand fell off slightly during the last week but prices remained unchanged.

The U. S. Bureau of Mines issued an Advance Summary of the Zinc Industry in 1934, showing that production in American plants amounted to 383,281 tons, valued at \$32,962,000, an increase of 14% in quantity and 16% in value over 1933.

Tin prices described a rather shallow clothesline curve. They began at 47.75, went as low as 45.75 and closed at 47.60. There were no outstanding developments during the month.

Lead was steady at 3.40 for the first two weeks, rose to 3.45 and closed at 3.50, E. St. Louis. Sales were improved and the metal was more active throughout until the last of the month when the

buying decreased a little, perhaps due to the increased price.

Aluminum was unchanged throughout at 22.00. The U. S. Bureau of Mines published an Advance Summary of the Industry in 1934 showing that new aluminum produced in the United States amounted to 74,177,000 pounds valued at \$14,094,000, compared with 85,126,000 pounds valued at \$16,174,000 in 1933. One of the reasons for this decrease was the suspension of production for a month during a period of labor difficulties, and the fact that another month was required before activity at the furnaces could be fully resumed.

World production is estimated at 169,000-metric tons in 1934, an increase of about 19% over 1933. According to preliminary estimates, Germany produced more aluminum than the United States.

Antimony was stationary at 14.50.

Nickel was unmoved at 35.00.

Silver was consistently strong from the beginning to the end. It started at 56.875c. per ounce and closed at 60.75. The cause of the rise was reported to be sustained and active buying in China and India, and heavy speculative purchases in the London market.

The world output of silver in February amounted to 14,801,000 ounces compared with 15,717,000 in January and 13,390,000 in February 1933, according to the American Bureau of Metal Statistics.

Platinum was again rather weak, slipping from \$32.00 to \$31.00 per ounce. The world consumption of new platinum in 1934 was estimated at 200,000 ounces by the International Nickel Company (who are now important producers of the metal) as compared with 175,000 ounces in 1933.

Gold was unchanged at \$35.00 an ounce.

Scrap Metals were varied in their activity. During the first week copper and brass scrap, aluminum and zinc were firm to strong except for copper radiators for which bids were dropped slightly. This tendency continued until the third week when an easier tone appeared in aluminum. The price rise of new copper abroad limited the scrap offerings toward the end of the month, which were held in view of the prospects for better prices.

The combined shipments and deliveries of ingot brass and bronze made during the calendar month of January, 1935, amounted to 5,338 net tons.

Average prices per pound on Commercial Grades of six principal mixtures of Ingot Brass during the twenty-eight day period ending March 22, were:

Commercial 80-10-10 (1½% Impurities)	9.880c.
Commercial 78% Metal	7.514c.
Commercial 81% Metal	7.754c.
Commercial 83% Metal	8.006c.
Commercial 85-5-5-5	8.266c.
Commercial No. 1 Yellow Brass Ingot	6.509c.

WROUGHT METAL MARKET

March was on the whole a fair month, showing the effect of a seasonal improvement. A leading distributor in the Metropolitan District reported their business as 14% above February 1935 and just about the same as in March 1934. Prospects are not discouraging although the rate of activity is limited by the slow development among such major consumers as building.

The mills have been fairly busy, due partly to automobile industry orders; also it is rumored, to heavy orders for munitions.

Daily Metal Prices for March, 1935

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	1	4	5	6	7	8	11	12	13	14	15	18
Copper c/lb. Duty 4 c/lb.												
Lake [†] (del. Conn. Producers' Prices)	9.125	9.125	9.125	9.125	9.125	9.125	9.125	9.125	9.125	9.125	9.125	9.125
Electrolytic [‡] (del. Conn. Producers' Prices)	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
Casting (f.o.b. ref.)	7.50	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75
Zinc (f.o.b. East St. Louis) c/lb. Duty 1¼ c/lb.												
Prime Western (for Brass Special add 0.05)	3.85	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90
Tin (f.o.b. N. Y.) c/lb. Duty Free, Straits	47.75	47.35	47.25	46.70	46.80	47.45	46.95	46.75	47.125	47.20	47.10	46.00
Lead (f.o.b. St. L.) c/lb. Duty 2½ c/lb.	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.45
Aluminum c/lb. Duty 4 c/lb.	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00
Nickel c/lb. Duty 3 c/lb.												
Electrolytic 99.9%	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00
Antimony (Ch.99%) c/lb. Duty 2 c/lb.	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50
Silver c/oz. Troy, Duty Free	56.875	58.00	57.75	57.625	58.375	58.75	58.75	58.625	58.625	58.875	59.125	58.875
Platinum \$/oz. Troy, Duty Free	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	31.00	31.00	31.00	31.00
Gold—Official Price \$/oz. Troy	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00
	19	20	21	22	25	26	27	28	29	High	Low	Aver.
Copper c/lb. Duty 4 c/lb.												
Lake [†] (del. Conn. Producers' Prices)	9.125	9.125	9.125	9.125	9.125	9.125	9.125	9.125	9.125	9.125	9.125	9.125
Electrolytic [‡] (del. Conn. Producers' Prices)	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
Casting (f.o.b. ref.)	7.75	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.60	7.75	7.50	7.590
Zinc (f.o.b. East St. Louis) c/lb. Duty 1¼ c/lb.												
Prime Western (for Brass Special add 0.05)	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.90	3.85	3.896
Tin (f.o.b. N. Y.) c/lb. Duty Free, Straits	45.75	45.95	45.75	45.85	47.25	47.40	47.50	47.60	47.60	47.75	45.75	46.908
Lead (f.o.b. St. L.) c/lb. Duty 2½ c/lb.	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.50	3.50	3.50	3.40	3.429
Aluminum c/lb. Duty 4 c/lb.	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00
Nickel c/lb. Duty 3 c/lb.												
Electrolytic 99.9%	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00
Antimony (Ch.99%) c/lb. Duty 2 c/lb.	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50
Silver c/oz. Troy, Duty Free	58.875	58.875	58.75	59.00	60.00	61.25	61.00	61.00	60.75	61.25	56.875	59.048
Platinum \$/oz. Troy, Duty Free	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00	32.00	30.00	30.881
Gold—Official Price \$/oz. Troy	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00

† Blue Eagle Copper. ‡ United States Treasury price.

Metal Prices, April 1, 1935

(Import duties and taxes under U. S. Tariff Act of 1930, and Revenue Act of 1932)

NEW METALS

Copper: Lake, 9.125, Electrolytic, 9.00, Casting, 7.75.
Zinc: Prime Western, 3.90. Brass Special, 4.00.
Tin: Straits, 47.85. Pig, 99%, 46.50.
Lead: 3.50. Aluminum, 22.00. Antimony, 14.50.
Nickel: Shot, 36. Elec., 35.

Duties: Copper, 4c. lb.; zinc, 1½c. lb.; tin, free, lead, 2½c. lb.; aluminum, 4c. lb.; antimony, 2c. lb.; nickel, 3c. lb.; quicksilver, 25c. lb.; bismuth, 7½%; cadmium, 15c. lb.; cobalt, free; silver, free; gold, free; platinum, free.

Quicksilver: Flasks, 75 lbs., \$73.00. Bismuth, \$1.10.
Cadmium, 65. Silver, Troy oz., official price, N. Y., April 2, 61.25c. Gold: Oz. Troy, Official U. S. Treasury price, April 2, \$35.00. Scrap Gold, 6¼c. per pennyweight per karat, dealers' quotation. Platinum, oz. Troy, \$31.00.

INGOT METALS AND ALLOYS

	Cents lb.	U. S. Import Duty	Tax*
Brass Ingots, Yellow.....	6½ to 8	None	4c. lb.†
Brass Ingots, Red.....	8½ to 11	do	do
Bronze Ingots.....	9¾ to 12½	do	do
Aluminum Casting Alloys.....	15½ to 22	4c. lb.	None
Manganese Bronze Castings.....	20 to 34	45% a. v.	3c. lb.‡
Manganese Bronze Forgings.....	26 to 38	do	do
Manganese Bronze Ingots.....	9 to 13	do	4c. lb.†
Manganese Copper, 30%.....	11½ to 16	25% a. v.	3c. lb.‡
Monel Metal Shot or Block.....	28	do	None
Phosphor Bronze Ingots.....	10 to 12	None	4c. lb.†
Phosphor Copper, guaranteed 15%.....	13¼ to 15	3c. lb.‡	do
Phosphor Copper, guaranteed 10%.....	11½ to 14	do	do
Phosphor Tin, no guarantee.....	61 to 75	None	None
Silicon Copper, 10%.....	18 to 30	45% a. v.	4c. lb.†
Iridium Platinum, 5%.....	\$34-35	None	None
Iridium Platinum, 10%.....	\$35-36	None	None

*Duty is under U. S. Tariff Act of 1930; tax under Section 60 (7) of Revenue Act of 1932.

†On copper content. ‡On total weight. "a. v." means ad valorem.

OLD METALS

Dealers' buying prices, wholesale quantities:	Cents lb.	Duty	U. S. Import Tax
Heavy copper and wire, mixed.	6¾ to 6¾	Free	4c. per pound on copper content.
Light copper.....	5½ to 5¾	Free	
Heavy yellow brass.....	3¾ to 3¾	Free	
Light brass.....	3 to 3¾	Free	
No. 1 composition.....	4¾ to 5¾	Free	None.
Composition turnings.....	4¾ to 4¾	Free	
Heavy soft lead.....	3 to 3¾	2½c. lb.	
Old zinc.....	2¼ to 2¾	1½c. lb.	
New zinc clips.....	2¾ to 3	1½c. lb.	None.
Aluminum clips (new, soft).....	12¼ to 13¼	4c. lb.	
Scrap aluminum, cast.....	9¼ to 10	4c. lb.	
Aluminum borings—turnings..	5 to 5½	4c. lb.	
No. 1 pewter.....	30 to 32	Free	10% a. v.
Electrotype or stereotype.....	2¾ to 3	2½c. lb.*	
Nickel anodes.....	30 to 33	10%	
Nickel clips, new.....	31 to 33	10%	
Monel scrap.....	11 to 18½	10% a. v.	

*On lead content.

Wrought Metals and Alloys

The following are net BASE PRICES per pound, to which must be added extras for size, shape, quantity, packing, etc., or discounts, as shown in manufacturers' price lists, effective since November 24, 1934. Basic quantities on most rolled or drawn brass and bronze items below are from 2,000 to 5,000 pounds; on nickel silver, from 1,000 to 2,000 pounds.

COPPER MATERIAL

	Net base per lb.	Duty*
Sheet, hot rolled.....	16c.	2½c. lb.
Bare wire, soft, less than carloads.....	12.75c.	25% a. v.
Seamless tubing.....	16.25c.	7c. lb.

*Each of the above subject to import tax of 4c. lb. in addition to duty, under Revenue Act of 1932.

BRASS AND BRONZE MATERIAL

	Yellow Brass	Red Brass	Comm'l. Bronze	Duty	U. S. Import Tax
Sheet.....	14¼c.	15¼c.	16	4c. lb.	4c. lb. on copper content
Wire.....	14¾c.	15¾c.	16½	25%	
Rod.....	12¾c.	13¾c.	16¾	4c. lb.	
Angles, channels.....	22¼c.	23½c.	24	12c. lb.	
Seamless tubing 16 c.	16¾c.	17¾c.	17¾	8c. lb.	No tax.
Open seam tubing 22¼c.	23½c.	24	20% a. v.		

NICKEL SILVER

Net base prices per lb. (Duty 30% ad valorem.)

Sheet Metal	Wire and Rod
10% Quality.....	23.50c.
15% Quality.....	25.625c.
18% Quality.....	26.875c.
10% Quality.....	26.375c.
15% Quality.....	30.75c.
18% Quality.....	34.00c.

TOBIN BRONZE AND MUNTZ METAL

	Net base prices per pound.	(Duty 4c. lb.; import tax 4c. lb. on copper content.)
Tobin Bronze Rod.....	16¼c.	
Muntz or Yellow Rectangular and other sheathing....	17¾c.	
Muntz or Yellow Metal Rod.....	13¾c.	

ALUMINUM SHEET AND COIL

(Duty 7c. per lb.)

Aluminum sheet, 18 ga., base, ton lots, per lb.	32.80
Aluminum coils, 24 ga., base price, tons lots, per lb.	30.50

ROLLED NICKEL SHEET AND ROD

Duty 25% ad valorem, plus 10% if cold worked.)

Net Base Prices

Cold Drawn Rods.....	50c.	Cold Rolled Sheet.....	60c.
Hot Rolled Rods.....	45c.	Full Finished Sheet.....	52c.

MONEL METAL SHEET AND ROD

Duty 25% ad valorem, plus 10% if cold worked.)

Hot Rolled Rods (base)	35	Full Finished Sheets (base) 42
Cold Drawn Rods (base)	40	Cold Rolled Sheets (base) 50

SILVER SHEET

Rolled sterling silver (April 2) 62c. per Troy oz. upward according to quantity. (Duty, 65% ad valorem.)

ZINC AND LEAD SHEET

	Cents per lb.	Duty
Zinc sheet, carload lots, standard sizes and gauges, at mill, less 7 per cent discount..	9.50	2c. lb.
Zinc sheet, 1200 lb. lots (jobbers' price) ...	10.25	2c. lb.
Zinc sheet, 100 lb. lots (jobbers' price)....	14.25	2c. lb.
Full Lead Sheet (base price)	7.00	2¾c. lb.
Cut Lead Sheet (base price)	7.25	2¾c. lb.

BLOCK TIN, PEWTER AND BRITANNIA SHEET

(Duty Free)

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f. o. b. mill:

500 lbs. or over.....	15c. above N. Y. pig tin price
100 to 500 lbs.	17c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price

Supply Prices on page 154.

Supply Prices, April 1, 1935

ANODES

Prices, except silver, are per lb. f.o.b., shipping point, based on purchases of 500 lbs. or more, and subject to changes due to fluctuating metal markets.

Copper: Cast	16½c. per lb.	Nickel: 90-92%	.45 per lb.
Electrolytic, full size, 14c.; cut to size	14c. per lb.	95-97%	.46 per lb.
Rolled oval, straight, 14½c.; curved,	15½c. per lb.	99%+ cast, 47c.; rolled, depolarized, 48.	
Brass: Cast	14½c. per lb.	Silver: Rolled silver anodes .999 fine were quoted April 2,	
Zinc: Cast	.08¼c. per lb.	from 64.25c. per Troy ounce upward, depending upon quantity.	

WHITE SPANISH FELT POLISHING WHEELS

Diameter	Thickness	Under 50 lbs.	50 to 100 lbs.	Over 100 lbs.
10-12-14 & 16	1" to 2"	\$2.95/lb.	\$2.65/lb.	\$2.45/lb.
10-12-14 & 16	2 to 3½	2.85	2.55	2.35
6-8 & over 16	1 to 2	3.05	2.75	2.55
6-8 & over 16	2 to 3½	3.00	2.70	2.45
6 to 24	Under ½	4.25	3.95	3.75
6 to 24	½ to 1	3.95	3.65	3.45
6 to 24	Over 3½	3.35	3.05	2.85
Any Quantity				
4 to 6	Under ½	\$5.00	½-1, \$4.85	1 to 3, \$4.75
1½ to 4	"	5.55	" 5.40	" 5.35
1 to ½	"	5.85	" 5.70	" 5.60

Extras: 25c per lb. on wheels, 1 to 6 in. diam., over 3 in. thick.
On grey Mexican wheels deduct 10c. per lb. from above prices.

COTTON BUFFS

Full disc open buffs, per 100 sections when purchased in lots of 100 or less are quoted:

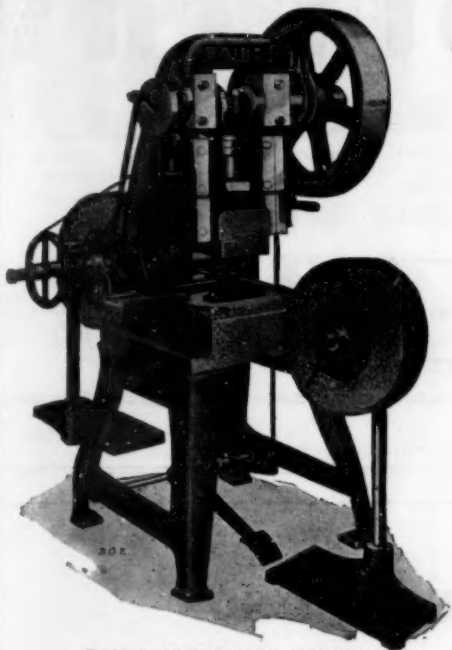
16" 20 ply 84/92 Unbleached	\$80.12
14" 20 ply 84/92 Unbleached	61.43
12" 20 ply 84/92 Unbleached	46.21
16" 20 ply 80/92 Unbleached	67.00
14" 20 ply 80/92 Unbleached	51.47
12" 20 ply 80/92 Unbleached	38.80
16" 20 ply 64/68 Unbleached	59.18
14" 20 ply 64/68 Unbleached	45.48
12" 20 ply 64/68 Unbleached	34.35
¾" Sewed Buffs, per lb., bleached or unbleached 49c. to 1.12	

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone C. P.	lb.	.13½-.16	Mercury Bichloride (Corrosive Sublimate)	lb.	\$1.58
Acid—Boric (Boracic) granular, 99½+ % ton lots	lb.	.04½-.05	Methanol, (Wood Alcohol) 100% synth., drums	gal.	.42½
Chromic, 400 or 100 lb. drums		.15¾	Nickel—Carbonate, dry, bbls.	lb.	.35-.41
Hydrochloric (Muriatic) Tech., 20 deg., carboys	lb.	.03	Chloride, bbls.	lb.	.18-.22
Hydrochloric, C. P., 20 deg., carboys	lb.	.06½	Salts, single, 425 lb. bbls.	lb.	.13-.14
Hydrofluoric, 30%, bbls.	lb.	.07-.08	Salts, double, 425 lb. bbls.	lb.	.13-.14
Nitric, 36 deg., carboys	lb.	.05-.06½	Paraffin	lb.	.05-.06
Nitric, 42 deg., carboys	lb.	.07-.08	Phosphorus—Duty free, according to quantity	lb.	.35-.40
Sulphuric, 66 deg., carboys	lb.	.02	Potash Caustic Electrolytic 88-92% broken, drums	lb.	.07½-.08¾
Alcohol—Butyl, drums	lb.	.13½-.14½	Potassium—Bichromate, casks (crystals)	lb.	.08¾
Denatured, drums	gal.	.475-.476	Carbonate, 96-98%	lb.	.08¾
Alum—Lump, barrels	lb.	.03¼-.04	Cyanide, 165 lbs. cases, 94-96%	lb.	.57½
Powdered, barrels	lb.	.03¼-.05	Gold Cyanide	oz.	\$15.45*
Ammonia, aqua, com'l., 26 deg., drums, carboys	lb.	.02½-.05	Pumice, ground, bbls.	lb.	.02½
Ammonium—Sulphate, tech., bbls.	lb.	.03½-.05	Quartz, powdered	ton	\$30.00
Sulphocyanide, technical crystals, kegs	lb.	.55-.58	Rosin, bbls.	lb.	.04½
Arsenic, white kegs	lb.	.04½-.05	Rouge—Nickel, 100 lb. lots	lb.	.08
Asphaltum, powder, kegs	lb.	.23-.41	Silver and Gold	lb.	.65
Benzol, pure, drums	gal.	.41	Sal Ammoniac (Ammonium Chloride) in bbls.	lb.	.05-.07½
Borax, granular, 99½+ %, ton lots	lb.	.02¼-.02¾	*Silver—Chloride, dry, 100 oz. lots	oz.	.48
Cadmium oxide, 50 to 1,000 lbs.	lb.	.55	Cyanide, 100 oz. lots	oz.	.53½
Calcium Carbonate (Precipitated Chalk), U. S. P.	lb.	.05¾-.07½	Nitrate, 100 ounce lots	oz.	.40
Carbon Bisulphide, drums	lb.	.05½-.06	Soda Ash, 58%, bbls.	lb.	.0252
Chrome, Green, commercial, bbls.	lb.	.21½-.23½	Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.16½-.22
Chromic Sulphate, drums	lb.	.33-.55	Beryllium fluoride (2NaF. BeF₂)	lb.	4.30-7.00
Copper—Acetate (Verdigris)	lb.	.21	Gold Cyanide	oz.	\$17.10*
Carbonate, 53/55% cu., bbls.	lb.	.14½-.16½	Hypsulphite, kegs, bbls.	lb.	.03½-.06½
Cyanide (100 lb. kgs.)	lb.	.38-.40	Metasilicate, granular, bbls.	lb.	3.55-3.70
Sulphate, tech., crystals, bbls.	lb.	4.55-5c.	Nitrate, tech., bbls.	lb.	.02½
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.20¼-.20¾	Phosphate, tribasic, tech., bbls.	lb.	.03¾
Crocus Martis (Iron Oxide) red, tech., kegs.	lb.	.07	Silicate (Water Glass), bbls.	lb.	.01½
Dextrin, yellow, kegs	lb.	.05-.08	Stannate, drums	lb.	.33-.36
Emery Flour	lb.	.06	Sulphocyanide, drums	lb.	.30-.45
Flint, powdered	ton	30.00	Sulphur (Brimstone), bbls.	lb.	.02
Fluorspar, bags	lb.	.03½	Tin Chloride, 100 lb. kegs	lb.	.36½
*Gold Chloride	oz.	\$18¼-.23	Tripoli, powdered	lb.	.03
Gum—Sandarac, prime, bags	lb.	.50	Trisodium Phosphate—see Sodium Phosphate.		
Shellac, various grades and quantities	lb.	.21-.31	Wax—Bees, white, ref. bleached	lb.	.60
Iron Sulphate (Copperas), bbls.	lb.	.01½	Yellow, No. 1	lb.	.45
Lead—Acetate (Sugar of Lead), bbls.	lb.	.10-.13½	Whiting, Bolted	lb.	.02½-.06
Oxide (Litharge), bbls	lb.	.12½	Zinc—Carbonate, bbls.	lb.	.11-.12
			Cyanide (100 lb. kegs)	lb.	.38
			Chloride, drums, bbls.	lb.	.07½-.10
			Sulphate, bbls.	lb.	.03-.037

* Gold and silver products subject to fluctuations in metal prices.

BAIRD AUTOMATIC POWER
PRESSES

THE SHOEMAKER TO HIS LAST

Being an expert driver of an automobile does not make one an expert designer and builder of motor cars nor does being an expert manufacturer of metal articles make one an expert in the design and construction of the machinery required to obtain highest production at lowest cost.

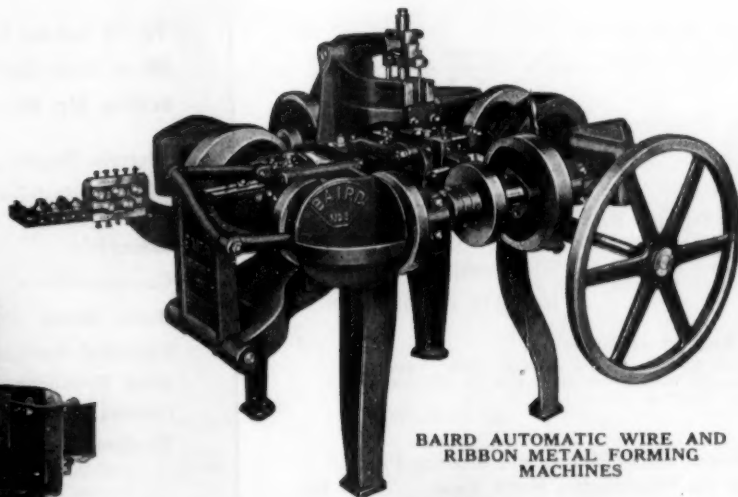
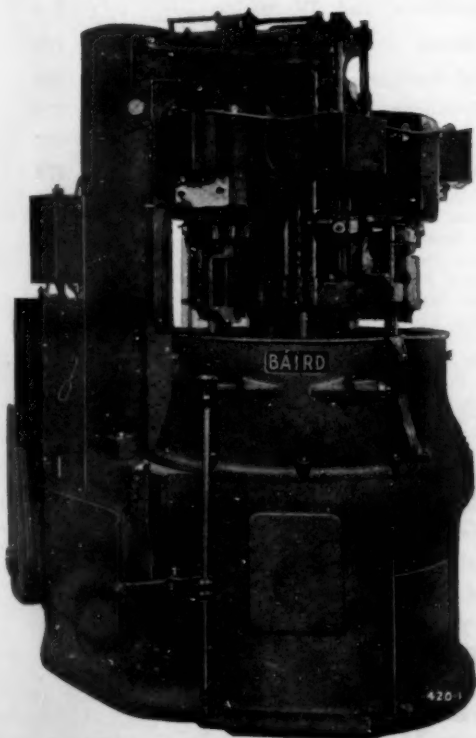
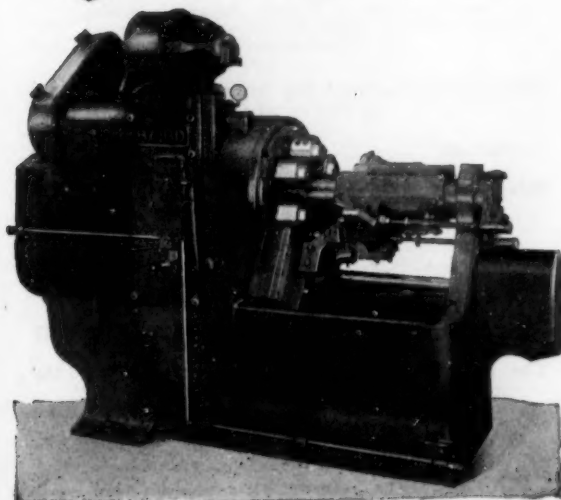
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MAY, 1935

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